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AIRCRAFT ENGINEER

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The Outlook

Forthright Language

LAST week we commented at some length on the state of the Royal Air Force, and on some of the problems and difficulties with which it is faced. This week we are very glad to publish an article by Air Chief Marshal Sir Philip Joubert, in which he traces the decline of the Service and the circumstances that have caused it.

We advise every one of our readers who has the welfare of the R.A.F. at heart to study that article carefully, and with the respect due to its distinguished author. Sir Philip transferred from the Army to the Royal Flying Corps in 1913, and he thus writes with a background of actual Service experience in both world wars.

It is very significant that Sir Philip lays the greatest stress on discipline, a fact which will not be very palatable to many in these days of slipshod slovenliness, but a fact which reflects his deep inside knowledge of the Service. All the more regrettable, therefore, that the Government has failed to realize the vital importance of doing everything possible to attract men of the right outlook who will, as Sir Philip puts it, devote not only their working hours but their hours of relaxation to their men.

While stressing, and rightly so in our view, the fundamental importance of discipline of the right sort, Sir Philip does not overlook the need for better pay generally and for the provision of married quarters, the lack of which has sent many a good man out of the Service. But, as we said last week, these will not in themselves ensure the flow of recruits to the R.A.F. Sir Philip puts its strongly but truly when he writes: "In the ultimate analysis the Service will never prosper, will never become popular again, until it has cleaned itself up from top to bottom, morally, intellectually and physically."

Aircraft Costs

QUANTITY does it, the beginner at shopkeeping is reported to have said when asked by a customer how he could sell his goods at less than cost price. So it seems to be with aeroplanes. The figures given by Mr. G. Edwards in his lecture to the Royal Aeronautical Society indicate that while civil aircraft are sold at £2 10s to £3 per pound of gross weight, they cost some £40 to £45 per pound gross weight to tool and develop. In military aircraft production, where large numbers may be built, there is just a possibility to see this outlay back after the first 400 or so have been built, but such orders do not come to builders of civil types, even in the United States, and in this country the orders can probably be divided by ten. As Mr. Edwards said, the manufacturer is virtually subsidizing the operator, and aircraft with established reputations, and giving valuable and efficient service on the world's airlines, are causing their manufacturers heavy losses.

Just how involved the whole thing is becomes clear when it is remembered that in spite of being thus virtually subsidized by the manufacturers, most American operating companies have been losing money. If they had had to pay a fair proportion of tooling and development costs, the losses would have been that much greater.

It is worth while bearing this simple fact in mind when operators claim that with suitable aircraft they could change losses into profits. The short answer is that they could not, if all relevant costs are taken into account. A balance sheet might be made to look as if it showed a profit, but only if many of the heavy expense items were omitted because they came out of "another pocket"—the taxpayer's. It is all rather like the mistaken idea which is so widespread just now that all these marvellous services we are getting are really "free."

Is there, then, no way out? Is there no way in which civil aviation can be made into a paying proposition? Frankly, we believe the answer is No, if we are honest about the matter and willing to bear in mind all those costs and expenses which have to be paid before aircraft can fly regularly on our routes. That is not to say, of course, that no attempt should be made to improve matters, and to aim at making the losses, open and hidden, as small as possible.

The Remedy

MR. EDWARDS suggested several ways in which greater economy might be achieved, the most fundamental of which was the greater use of variants of a basically good aircraft instead of being forever chasing after something just a little better. The cold, hard fact is that this country cannot afford the production of a multiplicity of new prototypes. Not that it is suggested that we should abandon all long-term planning. It is obviously wise to look ahead so as to bring in something very advanced in a few years' time. A case in point is the de Havilland D.H.106. But just how much can be achieved with a basically good design is indicated by another de Havilland machine, the Mosquito, which had appeared in many rôles before the war ended and excelled in them all.

There will not be general agreement with such a policy. Many operators will demur, especially those who are so fond of claiming that they could make flying pay if only they could get the right aircraft at the right time and at the right price. The fact is that the operators, at any rate the three Corporations, should be prepared to sacrifice something in operational economy for the lower first cost that would result from the use of a variant of an existing type.

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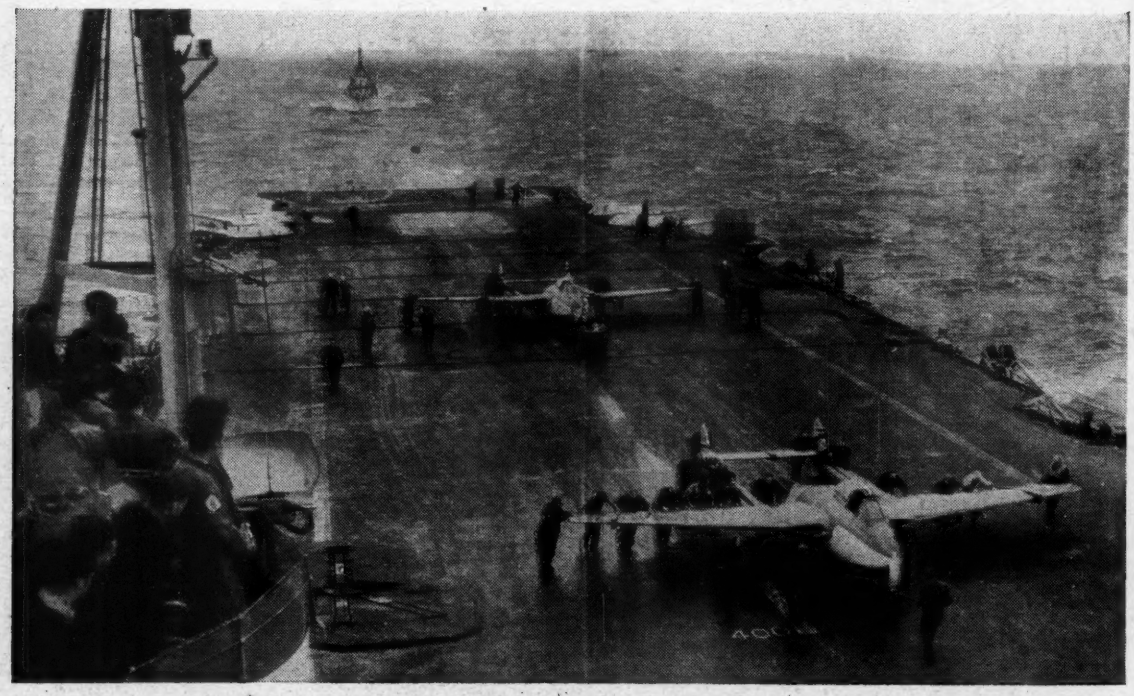
The old controversial subject of conversions from military to civil types was raised again and brought into focus by Mr. Edwards, who said that civil aircraft should be derived from basic military types, the original specification being laid down by the Director of Requirements at the Air Ministry, who should be advised by civil operators. With recent experience of conversions and stop-gap aircraft in mind, that suggestion may well seem to some a retrograde step. Much will, however, depend upon the actual aircraft types involved. The Royal Air Force never had sufficient transports of the right kind during the war. It is to be expected that, apart from any jet bombers it will have in future, it will need large numbers of transports, and already we have one good example of what can be done: the Handley Page Hastings and Hermes. It is to be assumed that B.O.A.C. will have to pay considerably less for the Hermes, owing to its community of components with the Hastings, than if that machine had to be designed and built as an entirely new type. And the Hermes certainly does not look like being an inferior type of civil transport.



GETTING THEIR SEA LEGS: De Havilland Sea Vampires have lately operated for the first time in a Naval exercise. They are seen aboard H.M.S. Illustrious, from which they were flown by officers of the Carrier Trials Unit. As a culmination of the exercises now under way (during the early stages of which Fairey Barracudas delivered a torpedo attack) R.A.F. bombers will simulate the dropping of an atom bomb on Naval units, and short-range strike aircraft will go into action.

MANNING THE R.A.F.

Better Pay, Accommodation and, Above All, Discipline, the Key to the Solution

LORD DOUGLAS OF KIRTLESIDE said not long ago that the R.A.F. is in danger of "dying on its feet." We have asked Sir Philip Joubert to give our readers his views and the benefit of his long and distinguished Service career. He transferred from the Army to the Royal Flying Corps in 1913, and among the many posts he has held in the R.A.F. are Deputy-Director of Personnel, Instructor at Imperial Defence College, Commandant R.A.F. Staff College, C.-in-C. Coastal Command, Inspector-General II of the R.A.F., and Deputy-Chief of Staff.

Air Chief Marshal Sir Philip Joubert.

By AIR CHIEF MARSHAL SIR PHILIP JOUBERT, K.C.B., C.M.G., D.S.O., R.A.F. (Retired)

IN Parliament and throughout the country there is a rising anxiety as to the circumstances in which the R.A.F., only a few years ago the most popular of the three Services, now finds itself short of trained men and recruits.

At the end of the war the prestige of the Royal Air Force was immensely high. Throughout the whole world the Service was regarded as efficient, gallant, and the biggest single factor in the winning of the war. In France in particular, in spite of the heavy blows which the R.A.F. had dealt their cities, French men and women were almost lyrical in their praises of, and sentimental in their affection for, "la Raf."

To-day we see a Service undermanned, and with aircraft many of which, for want of proper maintenance, are falling into innocuous desuetude—to use a Kipling phrase. How has this come about? Here let me say that I am voicing my own opinions, which to-day have no official sanction, and which are entirely my own business. But I must, of course, draw on my past experience to deduce the lessons which that experience should teach.

When, in 1943, I became an Inspector - General of the R.A.F., it was my duty extensively to visit the R.A.F. Stations and to report to the C.A.S. on the state of their discipline and morale. On the whole the situation was good. The scare which had resulted in my mission was largely unfounded, but certain things did emerge, and one more than any other: This was the immense effect upon a Station of the Station Commander's character, probity, enthusiasm and sense of discipline. The moment I arrived on a Station and had a look round I knew what I was going to find. If the Station was clean the airmen smart and contented, and the transport in good order, then I knew that I should find a Station Commander of high calibre. Where, in my investigations, I found conduct sheets filled with entries of minor crime, and where the behaviour of the W.A.A.F. left something to be desired, it was a foregone conclusion that the Station Commander was not up to his job.

Royal Air Force discipline has gone through some strange phases. In the old R.F.C. the discipline was of the Guards Brigade order. Our first Adjutant, Lt. Barrington-Kennet, came from the Grenadiers, and there were several other officers of the same type. In addition, the Royal Engineers, from whom a large proportion of our men were drawn, have a great tradition, and discipline is one of their strong points. In the result, the small party that went to France in 1914, some 100 officers and just over 1,000 men, were disciplined and loyal. During the 1914-18 war that small body was to be increased to 33,000 officers and 300,000 men, mostly drawn from civil life, or with only a veneer of Army training. Consequently the discipline deteriorated very badly in the last years of the war.

It took the R.A.F.—the heir to the R.F.C.—till the late twenties to get rid of the effects of this tremendous dilution. By the middle thirties the Service was once more disciplined, efficient and contented. The R.A.F. was sufficiently popular to enable us to pick and choose our recruits. Lord Trenchard's careful planning had produced a valuable nucleus of long-service men, and the rates of pay and the amount of accommodation available for married families were not open to serious criticism. By 1934 the Service consisted of some 3,000 officers and 30,000 men. Towards the end of 1944 this had increased to appreciably over a million officers and men. Once again, the effect of a tremendous dilution was to be felt, and towards the end of the war the standard of discipline, and of general efficiency, had markedly deteriorated. Even in 1943, as I knew from my personal observation, this rotting process had started.

I have said that Lord Trenchard's planning had produced a nucleus of long-service men of real value. When the war broke out, recruitment for long service was stopped. In nine years the natural run-off of that nucleus has reduced it to a fraction, and it is only just beginning to be replaced by some men who have re-engaged for further service, and by boys coming out from Halton.

Of the war emergency men there is this to be said: A big proportion of them were highly skilled men who had done a long apprenticeship and a number of years in industry. They gave of their best during the time they were with the Service, but they were not very tolerant of discipline, and they were very much inclined to think in terms of factory hours and factory

- **. . . effect upon a Station of the Station Commander's character, probity, enthusiasm and sense of discipline.**
- **In three years this new Pay Code has been found quite inadequate to meet the needs of officers and men.**
- **To put it quite bluntly the Air Ministry failed in their attempt to establish a strong nucleus o trained regular airmen. . . .**
- **Broadly speaking there are 8,000 married quarters and some 40,000 families entitled to live in them.**
- **What we want is more and not less discipline . . . administered by officers and n.c.o.s trained properly in the art of man management. . . .**
- **At no time since the war broke out have I noticed a serious effort to train officers properly to look after their men.**

Manning the R.A.F. . . . . .

methods. They had no very strong feeling for the Service. They had a broad loyalty to their country, and the Air Force had its appeal, but their time in the R.A.F. was an awkward intrusion in the ordinary conduct of their existence in home and industry. Long before 1945 they were beginning to think in terms of Release Groups and of when they could get out. Naturally their homes, their wives and their jobs called strongly. At least the release was orderly, although, unfortunately, unduly accelerated by the Socialist Government. The effect on the Service was disastrous. The combination of the cessation of regular enlistment from 1939 and the release of over a million skilled men and women in a matter of two and a half years practically destroyed it.

It may be said that the same occurred in 1919, but there is now a big difference. Whereas in 1919 it was possible for Lord Trenchard to eliminate all those elements which might have caused difficulty by the simple process (which indeed he had been commanded to carry out by the Government) of abolishing some 90 per cent of the squadrons and establishments, in 1945 we have attempted to keep an Air Force going on a quite considerable scale. Thus, though in the passage of time we have lost a high proportion of our regular craftsmen, and nearly all the skilled men enlisted under the wartime emergency, we have, as a matter of Government policy, to endeavour to provide a considerable fighter and bomber force in this country, numerous detachments in the East and Far East, and above all a Transport Command on a scale adequate to play the part in the Berlin air lift. To cap our difficulties we have a number of national service men, recruited for a matter of months, who are either disinterested or, if they show interest and try to learn their job, leave us just when they are beginning to be useful.

The prospect of being faced with this kind of problem after the war had been realized by the Air Ministry staff, but it is doubtful whether they fully appreciated the magnitude of the difficulties they were to meet. In the matter of pay they did their best. After a prolonged struggle the new Pay Code, which was supposed to take into account the depreciation of the pound, the rise in the cost of living, and other factors, was launched with a flourish of trumpets. In three years this new Pay Code has been found quite inadequate to meet the needs of officers and men. Not the least of its weaknesses resulted from the surrender of the Service Departments to the Treasury's demand, successfully resisted in the 1920s, for the taxing of marriage allowances.

Lack of Accommodation

Married quarters, which in 1934 had been reasonably adequate to the needs of a smaller Service, were known to be woefully short of the requirements of the new and larger Air Force, but I doubt if it had been fully appreciated what the consequences of this shortage was going to be. Owing to the expansion of the R.A.F., wartime stations in isolated areas have been retained as permanent stations. Few of these had any married quarters even in the shape of hired accommodation. As they were in isolated areas, building labour could not be found willing to work on the proposed new quarters, since it was very much more convenient for them to take employment on Council housing schemes in urban areas. As a result, some of our best men, who were married and with families, found themselves living in deplorable circumstances, separated from their wives and children and under constant pressure to find accommodation for them. Such a situation is not conducive either to contentment or good work, and case after case has come under my observation of men whose lives and hopes and loyalties were bound up in the Service, having applied for discharge because they could not stand the mental and physical strain of continued separation, and the expenses involved. The officers find it impossible to live on their pay, and many of the best are going out into civil life to find the success which the Service denies them.

The consequences of these difficulties are clearly seen in the recruiting figures. In 1946, when the prestige of the R.A.F. was still very high, recruiting figures were good and the number of young men coming forward for regular service was fairly adequate. The only disappointment was the misguided "Bounty" scheme, whereby it was hoped to bribe men already in the Service to continue for a few years and then to leave with a pocketful of money. For the skilled man with a family, this bribe had no appeal whatsoever. If he had been offered extended service for a number of years, with a prospect of a pension at the end of it, there is no doubt that he would have stayed. But, for a matter of £25 a year, to stay on while his demobilized colleagues were tucking themselves away in safe jobs in industry, was something which did not make sense to the majority. And so the scheme was a failure. And then, as time went by and the difficulties which I have outlined became more apparent, so the number of recruits coming forward for regular service dropped steadily, from some 4,000 a month to the present figure of about 800.

No Trained Regulars

To put it quite bluntly, the Air Ministry failed in their attempt to establish a strong nucleus of trained regular airmen capable of maintaining the required number of aircraft in serviceable condition. This situation was becoming so obvious a few months ago (and it applied to the other Services as well, although possibly in lesser degree) that a drive was started to improve the conditions of pay and allowances.

A few days ago the Minister of Defence published his programme of improvements. The officers get little or nothing, the improvement in marriage allowances being largely eaten up by income tax. With the present cost of living, the difficulty that has faced every married officer since the end of the war, that of making ends meet on his pay, still remains. The airmen are slightly better off, since they have improvements in pay and in marriage allowances, but these are not so startling as to make it likely that there will be a tremendous rush to join the Service. And the housing difficulty remains. Broadly speaking, there are 8,000 married quarters and some 40,000 families entitled to live in them, and the rate of building is, as the rate of building throughout the country, much too slow to meet the crying demands of the homeless.

So much for the purely material side. What of discipline and morale? The whole basis of good discipline and good morale is proper man management. At no time since the war broke out have I noticed a serious effort in the Service to train officers properly to look after their men. The tradition which has held in the Army and Navy for many years is still largely lacking in the Royal Air Force. There are, of course, shining exceptions, and Cranwell and Halton are certainly amongst these. But this has only been achieved by the most careful picking officers who have shown natural aptitude in this work. From the men's point of view I have so often heard it said that if only they were left to do their job in the way of the mechanics in a factory, if only there were no square-bashing, no guard mounting, no restrictions, then they would be perfectly happy.

That this is a fallacy can easily be proved. I have known stations where there has been an absolute minimum of disciplinary control, and I have never seen men more unhappy. By contrast stations at which the discipline is firm but just, where the officers care for their men in the way they should, are perfectly happy and the airmen accept the need for precision in the carrying out of orders, for organization, and for administration that calls for co-operation by all ranks. To my mind it is the most utter rubbish to say that the Service would be popularized by removing still further the already loosened bonds of discipline.

What we want is more and not less discipline, but it must be administered by officers and non-commissioned officers who have been trained properly in the art of man management, and who are prepared to give not only their working hours but their hours of relaxation to the service of their men. This is such a truism that it seems almost unnecessary to repeat it, but the fact remains that it is the one crying need of the Royal Air Force to-day; the one thing

it lacks almost more than anything else. Perhaps, by constant striving, we may persuade a jealous Treasury to relate its Pay Code to the real needs of officers in particular and men generally in this modern world; we may induce those in control of works services to erect an adequate number of married quarters both at home and abroad, but in the ultimate analysis the Service will never prosper, will never become popular again until it has cleaned itself up from top to bottom, morally, intellectually and physically.

This will take time, and I fear we must accept the position in which we find ourselves so long as the "cold war" continues and does not become a "shooting war." I assume that conscription of men who have already done war service and are fully skilled would be politically impossible until that happens.

All we can hope for, then, is that by the lapse of time, with patient training and by a wiser and less class-conscious financial policy on the part of the Government, the scars that the Service has suffered will be healed and contentment and efficiency once more become established. The machinery is there if it can be made to work. What it needs is lubrication and efficient operation.

TEST PILOTS DINE—

—AT FARNBOROUGH E.T.P.S.

THE annual dinner of the Empire Test Pilots School and presentation of the McKenna Trophy took place at the Assembly Hall, R.A.E., Farnborough, on Monday, Dec. 6th.

After the headmaster's "titfer" had been placed on his head, G/C. Ubee, the Commandant, rose to welcome the guests and to thank the many representatives of the industry and sciences for adding dignity to the occasion. He also thanked the industry on behalf of the school for their hospitality on visits during the year, and said that he interpreted this as a vote of confidence in the school. There was an essential one-man link between development and production in the aircraft industry, and that was the test pilot. Aircraft had ceased to be just a triumph of scientific progress, they were now indicative of national prestige and a barometer of national prosperity.

G/C. Ubee then announced this year's winner of the McKenna Trophy, won for the first time by a Naval officer, Lt. J. E. Elliott, R.N. The near runner-up was Major R. B. Meyersburg, U.S.M. (from the C.A.A. in Washington), who shared second place with Lt. D. W. Morgan, R.N. The third place was shared by two R.A.F. officers, and there were only four points difference between the first five contenders. The Commandant mentioned the new school motto, and made a characteristic quotation "in an Eastern language." He spoke of his predecessor who is now in industry and had hitched his wagon to a Planet.

The dinner this year marked two swan songs, S/L. Havercroft (President) in his seven years with the unit had done a lot for a lot of people and could retire with a clear conscience. The second swan song was that of G/C. Ubee himself. He said the blow was not unexpected, and he thanked the Air Ministry for the generous treatment and kindness to him. He becomes D.D.O.R.1 at the Air Ministry. The absence of Mr. Humphreys due to sickness, was regretted, and hopes were expressed for an early recovery.

The new Commandant, G/C. L. S. Snaith, A.F.C., of Schneider fame, was next introduced and crowned with the "titfer." It was not the first time he had worn a mortar board with blue tassel, an earlier occasion being as boy soprano in the cathedral choir.

Air Marshal Coryton expressed his pleasure in being able to get away from the office and talk to those intimately connected with aviation. Great thanks were due to G/C. Ubee and the E.T.P.S. Air Marshal Sorley's original conception of an E.T.P.S. had fulfilled all the intentions. Without the quality of test pilots to back up our designers most of our efforts would be in vain. G/C. Ubee would be a great loss to the school, but in going to the Air Ministry he was taking valuable practical experience over to the other side. He thought that the new Commandant, G/C. Snaith, was an admirable selection, and that the E.T.P.S. would go from strength to strength. Air Marshal Coryton then presented the McKenna Trophy to Lt. Elliott, who was loudly called to his feet after the presentation by his classmates. Lt. Elliott was glad to see the Navy was so well represented on the course, was proud to have been placed first, but felt it was a matter of choice who was called winner when all were so near the top. On behalf of the course he thanked G/C. Ubee and staff, and wished luck to the new Commandant.

This year's test pilot course, the completion of which is marked by the dinner, has been one of the most successful since the school was formed, and the standard reached is slightly higher than ever before. The school is now accommodated in its new quarters, comprising a completely rebuilt photographic section of the R.A.E. at Farnborough, and an ideal—almost an essential—has been realized in providing every pupil with a separate private cabin. The course went according to schedule in every respect, and in the ten months all completed the requisite 100 hours' flying or more. The aircraft position is good, both with regard to variety of types available and serviceability.

The course in order of passing out was as follows: 1, Lt. J. Elliott, R.N.; 2, Maj. R. B. Meyersburg, U.S.M., and Lt. D. W. Morgan, R.N. (tied); 4, F/O. A. C. Capper, R.A.F., and F/L. C. K. Saxerby, D.F.C., R.A.F. (tied); 6, F/L. P. A. Harpman, D.F.C., A.F.C., R.C.A.F.; 7, Lt. D. G. Parker, D.S.O., D.S.C., R.N., and F/L. W. J. Sheehan, D.F.C., R.A.F. (tied); 9, Lt. P. C. S. Chilton, R.N.; 10, F/L. M. Alston, R.A.F., and Capt. Boyd Grubaugh, U.S.A.A.F. (tied); 12, F/L. E. J. Roberts, R.A.F.; 13, S/L. I. N. M. McDonald, R.A.F., and F/L. R. Smyth, R.A.F. (tied); 15, F/L. W. J. Morrison, A.F.C., R.A.F.; 16, F/L. A. Ashworth, D.S.O., D.F.C., R.A.F., and Lt. W. H. Fearon, R.C.N. (tied); 18, Mr. D. J. Tayler, D.F.C., R.A.E.; 19, F/O. A. E. Gunn, R.A.F.; 20, Lt. J. S. Bailey, O.B.E., R.N.; 21, F/L. F. J. Hubbard, D.F.C., A.F.C., R.A.F., and S/L. P. L. Parrott, D.F.C., R.A.F. (tied).

—WITH CONSTRUCTORS AT BOSCOMBE DOWN

ONE of the most valuable and enjoyable social evenings of the year, the dinner given by the Aircraft and Armament Experimental Establishment to the aircraft constructors, took place at R.A.F. Station, Boscombe Down, last Friday, December 3rd. As usual, the guests included many leading aircraft manufacturers and a good proportion of test pilots.

A. Cdre. H. L. Patch, C.B.E., who commands Boscombe, proposed "The Guests," and said that he regretted that it had been impossible to accommodate more of the old friends of the establishment. It was an honour to entertain for the first time a Permanent Secretary of the Ministry of Supply (Sir Archibald Rowlands, G.C.B., M.B.E.). He spoke of carrying on Martlesham traditions and hoped that the industry had trust in Boscombe. In lighter vein he mentioned his searches through Air Ministry archives concerned with the history of Boscombe, and he referred to an ancient village which had been dug up on the airfield. Already in those days quicker decisions as to why flint arrowheads broke or not were being demanded.

Sir Roy Dobson was to have replied for the guests, but in his absence Sir Frederick Handley Page, C.B.E., took over this task, which is a familiar one to him. After saying how glad he was to be a guest, he added that such occasions were welcome when one could "drink one to another without any dirty business being involved."

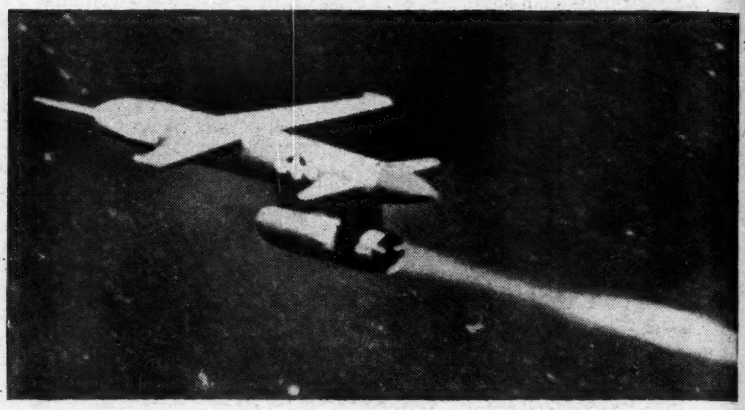
Commenting on a misprint on the menu, which gave Boscombe the status of "unit," Sir Frederick said that it was rightly described as an establishment, unlike the aircraft industry, which eked out a precarious existence and was not established.

He had always respected Martlesham figures, for they had the effect of bringing competitors down to their right level but always confirmed one's own claims. Boscombe, while keeping close to the user, observed fact, thus narrowing down pure speculative theory in which scientists engaged. In conclusion Sir Frederick said that there was happy collaboration between the industry and the Service, and he hoped the same good spirit would continue.

Air Marshal Sir Alec Coryton, C.B.E., M.V.O., D.F.C., stated that we did not have to look far back to see how important it was that the industry should think straight. "Co-operation between those who make them and those who break them was vital."

Mr. J. D. North, M.I.Mech.E., F.E.Ae.S., whose humorous speech appropriately rounded off an excellent dinner, spoke of Orfordness and reminded the guests that Boscombe was an armament as well as aircraft establishment. He told some amusing stories of the early days of aircraft construction, including references to Sir Frederick's activities. He referred to the happy relationship between industry and the A. and A.E.E., and expressed gratitude for the help given by the Establishment.

HERE AND THERE



RAM-JET TRIALS: In recent trials this pilotless aircraft, designated the PTV-N-2 and built for the U.S. Navy by the Glenn Martin Company, has been used for experiments in ram-jet propulsion at Point Magu, California.

School Holiday Concession

HALF fares on most B.O.A.C. routes are now available for school children visiting their parents overseas. Countries to which this concession does not apply are the United States and Canada. A similar concession was recently introduced by K.L.M. on flights radiating from Amsterdam during the recognized school holidays.

K.L.M. Convair 240

THE first Convair 240 aircraft to enter regular airline service in Europe are now being operated between Amsterdam and Stockholm by K.L.M., who have taken delivery of five of these machines recently and expect a further seven in the near future. The introduction of Convair 240s on the London-Amsterdam service has been scheduled to begin next January. K.L.M.'s entire fleet now totals 106 aircraft in operation throughout the world.

Theological Approach

PAYING tribute to the "perfectly magnificent" control arrangements of the R.A.F. at Gatow, a Berlin airlift pilot, Captain Pelly, of B.O.A.C., remarked recently that in bad weather it was the unruffled voice of the G.C.A. controller giving control directions, interspersed with a sense of humour, that was of greatest assistance to the pilots landing at Gatow. He quoted an example where one turning point was over a church: A pilot reported, "Over the church. Angels (height in thousands of feet) 1.5 and it's Sunday." Back came the answer from the G.C.A. controller, "O.K., take a pew!"

Scunthorpe A.T.C. Display

IN an attempt to bring the public, parents and schools into contact with the R.A.F. and its auxiliaries, the 119th Scunthorpe Squadron of the A.T.C. opened an equipment and training exhibition at their new Station Road, Scunthorpe, headquarters on December 5th. The exhibition which was opened by A. Cdre. Franks, A.O.C. of No. 1 Armament School, Manby, supported by the Mayor of Scunthorpe and the local A.T.C. committee, was preceded by a parade through the town of R.A.F. and A.T.C. units in Lincolnshire. Features of the exhibition include a sectioned gas turbine engine and display of navigational equipment, including maps of all kinds, radar aids and instruments. The engineering section of the exhibition contains engine accessories, teaching and instructional equipment and many varied diagrams. A squadron transmitting and receiving station for demonstrating radio and signals is equipped with sectioned sets and besides elementary demonstrations, W/T and R/T equipment is in actual operation. Admission to the exhibition, which is open to the public between 11 a.m. and 9 p.m. daily, is by programme, price 6d. The display closes on December 11th.

Dollar Saving by B.O.A.C.

AFTER a fortnight's tour of B.O.A.C. bases in America and Canada, Sir Miles Thomas, Deputy Chairman of B.O.A.C., returned to London on December 3rd. Sir Miles said that plans had been made to reduce the staff on B.O.A.C.'s dollar pay roll from 1,500 to less than 600 by next March. This reduction will effect an annual saving of 3½ million dollars, approximately £875,000. Speaking of the removal of the B.O.A.C. maintenance base from Dorval to Filton he said that most of the equipment had now been brought over and the first aircraft for routine overhaul at the new base would go to Filton on December 15th. The Atlantic Division of B.O.A.C., he said, in the half year which ended last September sold 3½ million dollars' worth of business.

Encouraging Tourists

DURING December Sir Alexander Maxwell, chairman of the British Tourist and Holidays Board, is making an extensive tour of the principal American cities to meet leading representatives of the travel and tourist trades. He will give a detailed survey of Britain's preparedness to cater for the growing volume of tourist traffic which is expected to include 150,000 American and Canadian tourists next year. As reported in *Flight*, November 25th, an intensive advertising campaign has been launched by the Tourist division of the British Tourist and Holidays Board. To deal with the rapidly increasing volume of enquiries the New York office of the Board's Tourist Division is to be moved from its present address in Fifth Avenue to much larger accommodation at 336, Madison Avenue, where a large window area for "Come to Britain" displays is available. These new offices will open on January 6th.

H.P. Appointments

NOW approved by the A.R.B. as an aircraft design company, Handley Page (Reading), Ltd., has announced the following appointments: Chief Designer, Mr. E. W. J. Gray, formerly of the Cierva Autogiro Co.; Mr. E. W. Pickston has been appointed works

EARLY TESTS: At Toulouse Blagnac the first prototype of the SE.2010 is undergoing taxying trials. It will probably fly early in January next year since only the instrument panel and final details have now to be installed. The fuselage and wing were constructed at Toulouse but the box-type spar with integral fuel tanks was made by the same company at Marignane, Marseilles. Air France have ordered twenty-five of these aircraft, of which three are already in an advanced stage of construction.

HERE AND THERE

manager; he was in charge of the aircraft repair depot at York managed by Handley Pages during the war. The sales manager is G/C. A. F. Bandidt, who was for a period the M.o.S. overseer at Miles Aircraft, Ltd. Mr. H. M. Kendall, formerly with Percival Aircraft, Ltd., has been appointed test pilot.

By Proctor to Australia

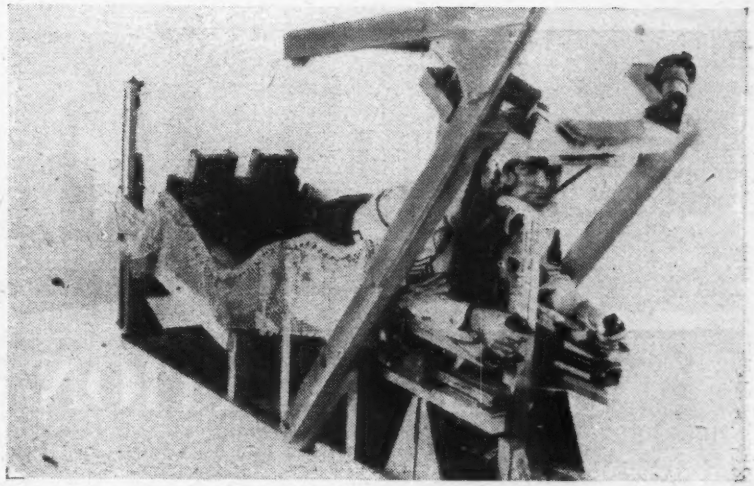
TWO authors, Mr. Nevil Shute and Mr. W. J. Riddell recently arrived in Darwin, Australia, flying a Proctor in which they set out from the U.K. on September 22nd. The flight was uneventful and undertaken on a fairly easy schedule. After a month or two, during which they will fly around Australia, they will return in the same manner.

Cornercroft A.G.M.

IN the absence of Capt. W. F. Stickland owing to illness Mr. J. A. Corner presided at the annual general meeting of Cornercroft, Ltd., on November 26th. In a circulated statement the chairman reported a very successful year and the directors recommended the same final dividend as has been declared on the ordinary shares in past years, that is, 9 per cent, making a total of 15 per cent for the year. A very profitable disposal of the fixed assets of the company's northern subsidiary was reported.

R.Ae.C. Film Show

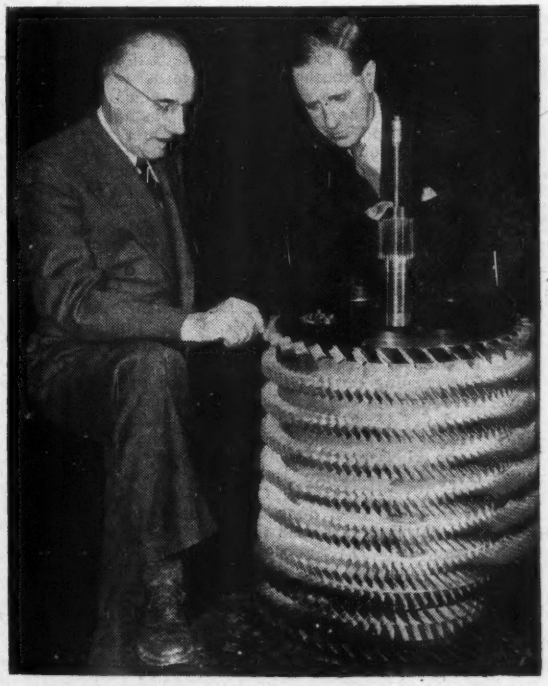
ALL members and associate members of the Royal Aero Club and their friends are invited to attend the Club's second film show this season, which will take place on December 14th at Londonderry House. This programme will include a colour film of the atom bomb experiments made at Bikini by the U.S. authorities. Two other colour films, one of the Berlin air lift in operation and the other of Their Majesties the King and Queen presenting the colours at the R.A.F. College, Cranwell, made by Mr. W. Courtenay, will complete the programme. Refreshments will be available before and after the show, which starts at 6.15 p.m.



FLAT OUT: Investigations into the merits of the prone position by pilots are being carried out by the Anthropometric Unit of the Biophysics Branch of the U.S. Aero-Medical Laboratory. There is a possibility of this device being tried out in a Fortress.

Wedding Reception at Londonderry House

FOLLOWING the wedding on November 26th of Mr. Alex Duncan and Miss Anne Walker, the reception was held at the Aviation Centre, Londonderry House. Proposing the toast of the bride (who has recently taken her "B" licence) and groom, the best man said that the past of both was in the air and he hoped the future would contain an heir. Mr. Alex Duncan, thanking the best man, said that he "had made all the necessary small adjustments and was responsible for the whole thing." A friend whose gift by request was to be a dog basket, had asked whether he (Alex) slept straight or curled up and how tall was he. The bride said: "Thank you very much and I hope you all like my wonderful hat." The consequence was laughter and a good party all round.



CANADIAN VISITOR: Mr. W. M. Deisher, vice-president and general manager of A. V. Roe Canada Ltd., discussing gas turbines with Mr. H. T. Chapman, director and general manager of Armstrong Siddeley Motors Ltd.

News in Brief

THE Aero Golfing Society have announced that they will hold their annual dinner at Londonderry House, 19, Park Lane, W.1, on Wednesday, December 15th. 7.15 for 8 p.m.

* * *

Several donations have been received by the Guild of Air Pilots Benevolent Fund as a result of a wish expressed by Mrs. Brackley that such donations should be sent instead of flowers as a tribute to A. Cdre. Brackley.

* * *

At the private exhibition of British radio components and test gear to be organized by the Radio Component Manufacturers' Federation in March, 1949, components for the electronic and telecommunication industries will be displayed. About a hundred manufacturers are expected to exhibit.

* * *

Mr. Whitney Straight, chief executive of B.O.A.C., said during a recent visit to Hurn that this airport may possibly be used as a landing base for civil aircraft powered by gas turbines. At present work is in hand at Hurn in preparation for its use by Hermes aircraft.

* * *

Mr. Gordon Russell, C.B.E., M.C., R.D.I., F.R.I.A., Director of the Council of Industrial Design, has accepted an invitation to join the Airport Furnishing Committee set up by the Minister of Civil Aviation to advise on heating, lighting, decoration and furnishing of passenger buildings at State-controlled airports.

* * *

The four-letter abbreviations of place names compiled from lists forwarded to I.C.A.O. are published in the appendices to Notice to Airmen No. 396. Notice to Airmen No. 395 contains the list of the I.C.A.O. publications which are now available from H.M. Stationery Office.

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Arrangements have been made between the Radio and Television Trust, Ltd., and their leading U.K. distributors to form a company to continue the distribution of Philco British-made radio and television equipment and other Philco products throughout the U.K.

CIVIL AVIATION NEWS

QBI OVER LONDON: A Pan American Douglas DC-4 is wheeled on to the tarmac at London Airport as the four days fog begins to disperse. After the Atlantic crossing the PAWA DC-4s fly only as far as Frankfurt but their Constellations fly on to the Far East.

Fog Delays Schedules : Corporations' August Statistics

THE FUTURE OF GATWICK

NOTICE has been given by the Ministry of Civil Aviation that in September, 1949, Gatwick airport is to be derequisitioned and returned to its orignal owners, Airports, Ltd. This measure has been dictated by reasons of economy since the M.C.A. feel that the continued requisition of the airport would not be justified by its future usefulness. The release of the airport will mean that it will revert to its pre-war size because the surrounding lands, including the racecourse, which were taken over to enlarge Gatwick, would be returned to their owners. The reversion of Gatwick to its pre-war state will involve the withdrawal of customs, radio and communication facilities and the reduced size and facilities will be unsuitable for the operation of any but small aircraft. This development will be regarded by many, especially charter firms, as a great loss to civil aviation generally and, it is thought, may lead to congestion at airfields where alternative accommodation would be sought such as Bovingdon and Blackbushe.

There would be serious if not insuperable difficulties in the way of operating Gatwick after its release. To make it into a modern airport would involve the laying down of hard runways and installation of modern technical equipment and, moreover the purchase of much land. As the area has been scheduled as a green belt this acquisition of land might not be practicable on account of restrictions of the Town and Country Planning Act. In view of these difficulties and the great expense that would be involved it is difficult to visualize how the airport could continue to operate on the present scale.

AIRLINES' FOG SERVICES

DURING the recent spell of foggy weather, the longest period of fog in the history of British civil aviation, strenuous efforts were made by the airlines to reduce the inconvenience to passengers to a minimum. B.O.A.C., though forced to delay some services, succeeded in operating 59 out of 73 B.O.A.C. services scheduled during the worst period of the fog (November 27th to December 2nd). Of these 59 services, 37 were operated at Hurn, 7 at London Airport, 5 at Prestwick, 9 at Southampton and 2 at St. Eval. Most of the remaining delayed flights left on December 2nd. B.O.A.C.'s staff at Hurn during this period was supplemented by assistance sent from London Airport and handled 135 aircraft movements and 2,268 passengers, which included B.O.A.C. services and those of airlines for which the Corporation acts as agents.

During four days 18 out of 20 K.L.M. services from London were grounded and arrangements were made for passengers to catch aircraft on inter-Continental services at Amsterdam. These arrangements involved the transportation of over 120 passengers by boat train to Holland and on one occasion the departure of the train was, at K.L.M.'s request, delayed in the hope that passengers returning by coach from Blackbushe would make the connection. On November 29th a party of 74 passengers escorted by a K.L.M. courier, made the sea crossing to the Hook of Holland. Of these, 62 were transported by road to Schiphol where they boarded aircraft for the Far East, South Africa, North America and the recently opened service to Buenos Aires. Stranded passengers at K.L.M.'s Sloane Street terminal were kept in touch with weather developments, served with refreshments and, where necessary, hotel accommodation was arranged for them.

FIDO FOR TAKE-OFF

FOR the first time since its installation at Blackbushe, completed in May, 1948, the Fido fog dispersal system was used on November 29th to enable a Viking belonging to Airwork, piloted by Capt. Harding, to take off for Accra on the Gold Coast. The Viking had been chartered for the Crown Agents for the Colonies to fly a consignment of bank notes urgently required in West Africa to Accra via Gibraltar. At the time the fog dispersal installation was lit up the visibility at Blackbushe was 30 yards and this was increased to between 600 and 800 yards, which enabled the Viking to take off. The whole installation was not illuminated on this occasion and while no accurate figures are available for the cost of the operation the M.C.A. estimate it at around £1,000. Though the dispersal of fog by this means has been used previously to enable aircraft to land this is the first time Fido has been put into operation to make possible the take-off of a civil aircraft. A description of the Blackbushe installation appeared in *Flight*, May 13th.

NUTTS CORNER IMPROVEMENTS

THE new terminal buildings at Nutts Corner airport were officially opened jointly by Mr. G. S. Lindgren, M.P., Parliamentary Secretary to the Ministry of Civil Aviation, and Mr. G. D'Erlanger, C.B.E., chairman of B.E.A., on November 26th. The opening ceremony was attended by the Governor of Northern Ireland, His Excellency Vice-Admiral the Earl of Granville, K.C.V.O., C.B., D.S.O.; the Minister of Commerce, Senator Major the Rt. Hon. Sir Roland Nugent, D.L.; the Lord Mayor of Belfast, Sir William Neill, M.P.; and the chairman of the Northern Ireland Civil Aviation Advisory Council, Mr. W. A. Edmenson, C.B.E. Mr. Lindgren reviewed the work that had been done to Belfast Airport in the past two years, during which time the sum of £163,000 had been spent. Approximately £30,000 a year would be needed to maintain the facilities and when fully completed the instrument landing installation would be up to the standard required at a first-class airport, Mr. Lindgren said. Continued expansion and continuation of existing services will be dependent upon the load factor and demand for increased traffic by the people of Ulster. The recent operation conveying milk from Nutts Corner to Britain has shown the capacity of

the airport to handle heavy traffic in all weather conditions to be considerably in excess of the present traffic. During a period of 8 weeks while Nutts Corner was handling the milk-run traffic in addition to normal scheduled services and charter flights, the total number of landings and take-offs amounted to 4,779; the maximum in any one period of 24 hours was 118 movements. During September Nutts Corner was the third busiest airport in the U.K., after Northolt and London Airport; actual figures of aircraft movements during the month being Northolt 4,708, London Airport 3,176 and Nutts Corner 2,995.

The work of transforming an ex-R.A.F. station into a first-class civil airport has been proceeding continuously since December, 1946. This has entailed grouping all buildings in one compact area rather than dispersing them as is necessary for military purposes. Structurally, the new passenger buildings have made little demand on the supplies of building materials since they are made up from a number of prefabricated hutments recovered from wartime military camps. These have been masked by gables to give the buildings an individualistic appearance. The likelihood of direct communications between Ulster and the Continent has been borne in mind when laying out the arrangement of facilities for Customs services, immigration clearance and public health formalities. Large numbers of travellers have been envisaged and rooms have been planned so that in-coming and out-going passenger flows are led clear of each other so as to avoid congestion. It is hoped that the restaurant, primarily intended for the convenience of air passengers, will become popular with motorists, and the management have provided a public enclosure with buffet for the convenience of visitors. Mr. D'Erlanger, who received the key of the buildings from Mr. Lindgren, stressed that these buildings, though a progressive step, were not meant to be regarded as more than an interim measure. He quoted figures illustrating the growth of the service in and out of Belfast and said that although in the light of present requirements the new buildings might appear commodious they might well be insufficient for traffic in a few years' time.

BREVITIES

ON November 25th a proving flight was made by T.C.A. from Montreal and Toronto to the Caribbean. The six-day trip included stops at Nassau, Bahamas; Kingston and Montego Bay, Jamaica; and Port of Spain, Trinidad. Following this the new service began on December 2nd and the route, which covers a distance of 3,386 miles, is scheduled to take about 15 hours to fly.

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An extension of the K.L.M. South Atlantic service to Buenos Aires began with the flight of a DC-6 from Schiphol on November 29th. This extension will bring Buenos Aires to within less than two days' flying time from Amsterdam and will save 9½ hours for passengers who have hitherto had to travel by sea from Montevideo, the previous K.L.M. terminal. The South Atlantic service operates twice a week flying alternately via Rome and Tunis and by Geneva and Lisbon. These routes join at Dakar and continue via Recife, Rio de Janeiro to Montevideo and Buenos Aires. In two years this service has carried over 12,000 passengers, 150 tons of freight and 20 tons of mail between Europe and Latin America.

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B.S.A.A. have announced that the Lancastrians at present used on their routes to Havana, the west coast of South America and across the Andes from Santiago to Buenos Aires

British Airways' Operating Statistics for August, 1948

TRAFFIC figures for August recently published by the M.C.A. show that the three British Corporations carried a higher number of passengers in August than in any previous month, the number totalling over 96,000. Route mileage of the Corporations covered 104,460. During August aircraft of the three Corporations flew over 4,000,000 miles on scheduled services, this figure being an increase of 3 per cent over the figure for August, 1947. Other increases over August, 1947, figures were shown in the passenger miles flown (21 per cent increase), mail ton-miles flown (19 per cent increase), freight ton-miles flown (42 per cent increase). Stage flights scheduled for the month numbered 10,388 and these were operated at regularity factors of 99.3 per cent on international services and 97.5 per cent on domestic routes. Owing to the reorganization of B.O.A.C. only two divisions are shown for the Corporation in place of three previously. Thus, the Atlantic Division is now referred to as the Western Division and the former African and Middle East Divisions are referred to as the Eastern Division. Figures for August, 1947, are shown in brackets.

	B.E.A. All Divisions	B.E.A. British Division	B.E.A. Continental Division	B.O.A.C. All Divisions	B.O.A.C. Western Division	B.O.A.C. Eastern Division	B.S.A.A
Passengers carried	85,615 (77,807)	60,035 (59,992)	25,580 (17,815)	11,399 (9,871)	4,374 (3,180)	7,025 (6,691)	1,365 (1,155)
Cargo Carried : Mail (tons)	234.3 (99.3)	100.4 (52.1)	113.9 (47.2)	135.4 (124.9)	25.2 (22.9)	110.2 (102.0)	15.1 (14.4)
Freight (tons)	479.3 (279.5)	112.2 (101.4)	367.1 (178.1)	239.8 (155.5)	39.3 (24.1)	200.5 (131.4)	34.4 (33.1)
Average Load : Passengers (No.)	15.1 (11.2)	13.7 (8.1)	16.4 (17.6)	16.1 (12.8)	27.4 (25.6)	13.8 (10.9)	9.6 (10.8)
Total (lbs)	3,092 (2,208)	2,501 (1,447)	3,566 (3,575)	4,629 (3,859)	6,990 (6,286)	4,203 (3,499)	3,264 (3,886)
Average Capacity Available : Seats (No.)	20.9 (14.2)	18.0 (10.5)	23.4 (21.8)	23.8 (17.9)	42.4 (40.4)	20.1 (14.5)	18.3 (18.4)
Total (lbs)	4,735 (3,519)	3,873 (2,309)	5,427 (5,691)	7,452 (5,708)	11,684 (10,732)	6,689 (4,963)	6,742 (6,825)
Average length of Haul : Passenger	240 (201)	149 (127)	452 (450)	3,016 (2,992)	2,331 (2,357)	3,415 (3,300)	3,396 (3,868)
Mail	423 (416)	161 (122)	619 (740)	4,635 (4,486)	3,513 (3,457)	4,892 (4,717)	5,671 (5,823)
Freight	440 (464)	180 (146)	520 (645)	3,490 (3,470)	2,947 (3,139)	3,597 (3,530)	5,567 (6,083)
Hours flown : Revenue : passenger services	9,494 (10,906)	5,339 (8,216)	4,155 (2,690)	10,967 (11,447)	1,420 (1,240)	9,547 (10,207)	2,300 (1,952)
cargo services	618 (410)	— —	618 (410)	869 —	— —	869 —	74 —
charter and special flights	55 (48)	55 (48)	— —	2 (440)	— —	2 (440)	— (17)
Non-revenue, total	202 (271)	97 (217)	105 (54)	1,652 (1,740)	839 (654)	813 (1,086)	257 (151)
Equivalent annual utilisation (revenue hours flown) per aircraft	1,601 (1,439)	1,469 (1,492)	1,784 (1,301)	1,400 (1,445)	— —	— —	1,456 (1,363)
Unduplicated route miles in operation at end of period	16,062 (17,636)	4,371 (6,448)	11,691 (11,188)	(64,026) (62,408)	8,523 (7,748)	55,503 (54,660)	24,375 (20,674)
Percentage regularity	97.9 (99.4)	97.5 (99.3)	99.2 (100.0)	99.3 (99.6)	99.7 (99.6)	99.2 (99.6)	100.0 (98.2)
Average length of stage flights (miles)	179 (126)	112 (96)	392 (356)	949 (865)	1,104 (1,161)	926 (835)	1,105 (1,251)

Civil Aviation News .....

are to be replaced by Tudor IVs. At present the Tudor IVs are used only between London and Jamaica and this will be the first scheduled Tudor service to extend as far as Buenos Aires. The first Tudor IV bound for Santiago left London on December 4th and the service operates once a week in each direction. The new Tudor flights to Havana, with connection to Mexico City, began on December 6th and also operates once a week. On December 9th the change-over from Lancastrians to Tudors on the B.S.A.A. connection between Santiago and Buenos Aires takes effect. The Yorks now being operated on the east coast route to Brazil and the Argentine are due to be replaced by Tudor IVs in February, 1949.

* * *

In preparation for the introduction of new codes for the transmission of meteorological information to and from aircraft in flight, which were approved for universal use from January 1st, 1949, by the International Meteorological Organization meeting at Washington in September, 1947, *Notice to Airmen* No. 391 gives details of these codes. This has been done so that operators may become conversant with them before the date of their introduction. The latest information relating to the temporary conditions prevailing at United Kingdom Airfields is contained in *Notice to Airmen* No. 394.

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Comparative figures for passengers, freight and mail carried by B.E.A. in October, 1948 and 1947 reveal an increase this year of 5,444 passengers; increases in freight and mail were 441,241 lb and 245,926 lb respectively.

* * *

The Pan American Airways' direct air service from Seattle and Portland to the Orient via Honolulu referred to in *Flight*, October 28th, began in November 24th. To start with the service operates twice weekly, on Wednesdays and Saturdays outward, returning on Sundays and Fridays. A third weekly flight will be added in March, 1949. The aircraft are equipped with "sleeperette" seats.

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Conforming with I.C.A.O. recommendations it has been decided to effect frequency changes as from December 30th of H.F. R/T Airfield Control at numerous airfields. Details of these alterations to frequencies are given in *Notice to Airmen* No. 405.

* * *

The service between Malta, Tunis, Algiers and Tangier operated by Air Malta, Ltd., has been temporarily suspended.

A.N.A. BRISTOL FREIGHTER: This Bristol freighter left Filton on November 23rd on its delivery flight to Melbourne for service with Australian National Airways. A.N.A. plan to use it on the route between Melbourne and Tasmania and it is expected that a fairly rigorous schedule will be arranged on these flights, possibly involving 10 to 12 hours flying a day.

It is hoped that the service will be resumed shortly, and in the meantime Air Malta have arranged with their agents in Tangier to route via Casablanca and Tunis any passengers in possession of Tickets to Malta.

* * *

It has been decided by the Air Transport Licensing Board of the Indian Government that provisional licences are to be granted to Indian air transport companies to operate scheduled air services to East China and Australia. The East China route will cover Calcutta, Saigon, Hong Kong and Shanghai, and the Australian route will lie through Calcutta, Bangkok, Singapore, Batavia, Sourabaya, Darwin and Sydney.

* * *

A provisional air agreement has resulted from recent talks between the Governments of India and Iran. This provides for an Iranian airline and an Indian airline, both designated by their respective governments, to operate on the Teheran-Zahidan-Karachi-Bombay route. It is understood that the Iranian airline will be in a position to start its services in the near future.

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Commercial traffic returns of Air France for the first six months of 1948 show that the company flew 11,061,120 miles during this period compared with 8,937,475 miles flown during the same period of 1947. The comparative figures for passengers carried in the first half of 1948 and 1947 were 243,917 and 174,858 respectively. Increases were also shown in mail and baggage figures and also in the weight of newspapers and freight carried. The total commercial load carried by the company represented an increase of 40 per cent on the figures for the same period in 1947.

FROM THE CLUBS

THE second formal dinner-dance of this season was held by the Brough Flying Club on November 19th. Over a hundred members and guests attended a successful evening.

* * *

FOLLOWING the annual general meeting at 3 p.m. on Saturday, December 11th, Surrey Gliding Club are holding a Christmas party at 5 p.m., starting with coloured films taken and shown by Dr. Peter Devitt. The club's bar will be open and a buffet supper with punch will be provided. Further details can be obtained from the club's chief instructor, Dr. L. Welch, Redhill Airfield.

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APPROXIMATELY 250 applications have been received by the Royal Aero Club for the Maintenance Schedules for privately owned light aircraft, details of which appeared in the preceding issue of *Flight*. These applications cover twenty different types of aircraft, and to date over 60 repairers and clubs have been officially approved to carry out maintenance on the lines described; this list is continually being added to. Applications for approval are made to the A.R.B., who recommend the names of suitable applications to be added to the Royal Aero Club's list of approved establishments. In order to avoid confusion it should be pointed out that the maintenance scheme referred to in *Flight*, December 2nd, and previously on May 20th, is that which has been drawn up by the Royal Aero Club applicable to privately owned light aircraft. A somewhat similar agreement which has been reached between the Association of British Aero Clubs and the A.R.B. and which refers to light aircraft used by flying clubs was described in *Flight*, May 6th.

* * *

MENTION was made in *Flight*, November 18th, that the Orkney Flying Club was considering the purchase of an aircraft of its own. The machine being considered is a Gypsy Moth 60 and it has been flown by a club member, Capt. Barclay, and reported to be in good condition. A decision will be made on the matter by the end of December. A large-scale publicity campaign has been launched by the club to raise funds and also to promote private flying.

* * *

FLYING weather at the Hereford Aero Club was good in the early part of November and the club has been fairly active. An outstanding performance recently was by Mr. P. Marriott, who soloed an Auster after only 4½ hours' dual instruction, having had no previous flying experience. The club received a surprise visit from two German Air Force pilots, both of them students visiting this country on a sponsored scheme. One was a former jet pilot and the other a glider pilot, and both were delighted with the Austers. The gliding section of the club has also been active. One member, Mr. L. Woolcott, has quite a fleet of privately owned machines comprising an Auster, a Tiger and a Proctor. Being a keen yachtsman he is now contemplating the purchase of an amphibian to enable him to get right to the coast at week-ends.

TWO IMPORTANT YEARS

A Review of the Official Report on Civil Aviation During 1946 and 1947

BEFORE the last war, from 1919, the Department of Civil Aviation formed part of the Air Ministry. That organization remained, even after the first Minister of Civil Aviation was created in 1944, until the Ministry of Civil Aviation was formed as a separate Government department in April, 1945. During those years the Air Ministry published annual reports on the progress of civil aviation, and it is on similar lines that the new Ministry has produced a publication dealing with the first two post-war years. The report is published by H.M.S.O. and sells at 2s.

In an introduction the report refers to some of the principal factors resulting from the war which determined the character of civil aviation in the immediately post-war years and the nature of its growth. Civil aviation had benefited by the immense technical advances in the design and construction of airfields, airframes and engines, radio and radar. Also on the credit side the now general acceptance of flying was important. On the other hand, civil aviation in the international field was a highly competitive business, and a short account is given of the difficulties in converting the aircraft industry from the production of fighters and bombers to the manufacture of civil aircraft. The introduction also includes a reference to the interim programmes and the long-term phase of aircraft manufacture which includes the building of such types as the de Havilland Comet, the Bristol Brabazon, the Bristol 175, the Ambassador and the Marathon. It refers, rather surprisingly, to the Handley Page Hermes as an interim aircraft.

Service Airfields Unsuitable

On the subject of airfields the introduction refers to the legacy of a large number of airfields constructed for the R.A.F. during the war and which were sited and dispersed according to strategic and military requirements, and were, therefore, inconveniently located or unsuitably planned and constructed for civil application. After reference to the building-up of London Airport the Ministry takes credit for the development of Prestwick, Belfast, Renfrew and Liverpool, and many other provincial airfields. A diary of civil aviation starting on October 8th, 1944, with the appointment of Lord Swinton as the first Minister of Civil Aviation and ending with the civil air agreement between the U.K. and Peru which was signed on December 22nd, 1947, forms a useful chronology of events for reference. The special chapter on air services is introduced with a reference to Government policy on the nationalizing of British civil air transport, to the formation of the three Corporations, and their respective spheres of operation. A brief account of the taking over of routes from R.A.F. Transport Command by the civil air operators serves as a reminder of the difficulties which were experienced in that transition period. The services of B.O.A.C., B.E.A., and B.S.A.A., are dealt with under the main routes on which they operate. In addition, tables in the Appendices show the development of the Corporations' services route by route, and their fleets.

It is surely rather daring that the report starts one subchapter with the question: "How do the Corporations finance the vast system of international air services described?" It then goes on to describe how, like any other business, they buy their capital equipment, mainly aircraft and stores, either by the issue of stock or by receiving temporary loans. Secondly, their aim is to cover their running expenses and overheads by earnings. During the first ten years, however, their earned revenue may be supplemented by grants from public funds to meet the unavoidably heavy expenses of starting anew and developing after the war, and to enable them to run services required in the public interest which are not attractive commercially. The remainder of that sub-chapter refers to the deficits incurred by the three Corporations. Referring to the International Air Transport Association the report states that during 1946 and 1947 it did not go beyond the fixing of rates for passenger fares, excess baggage and freight, but the Government had encouraged the Association to extend its activities to other forms of traffic and particularly air mail in order to avoid uneconomic rate warfare. It is interesting to be reminded that during 1946 and 1947 air-mail rates were reduced. On the North Atlantic route the postage rate came down from 1s 3d to 1s per half ounce and a substantial reduction was made in the conveyance rate paid to the operator. The general 1s 3d per half ounce to all countries on the Empire routes was replaced by zonal rates ranging from 6d to 1s 3d per half ounce, though the 6d light air letter was kept in being. The system of payments made to British airlines on the Empire routes was for the time being left unaltered. Postage rates to the Caribbean, and South America, were also brought down, and on April 1st, 1947, the Empire air-mail scheme was withdrawn.

STATISTICS OF LICENCES HELD.

	Dec. 1938	Dec. 1945	Dec. 1946	Dec. 1947	Women holders	Percentage increase 1946 to 1947
Pilots' "A" ...	5,352	649	2,510	3,330	100	33
Pilots' "B" ...	952	917	1,637	2,517	22	53
Navigators	533	600	917	2,027	5	120
Operational Eng.	(Did not exist)		147	281	3	90
Maintenance Eng.	1,984	2,044	2,593	3,122	1	20
Totals, all types	8,821	4,210	7,804	11,277	131	—

Air Charter

During the years 1946 and 1947 there was a progressive resumption of charter and hire flying and at the end of 1947 there were 85 firms actively engaged in air charter work, compared with some 65 in 1946, and, despite early post-war difficulties, including currency and travel restrictions and petrol rationing, charter operations in 1947 roughly doubled the four million aircraft miles flown during the previous year. The British Air Charter Association, constituted on August 1st, 1946, with a membership of 23, had, by the end of 1947, increased its membership to 41. Very little space, understandable though disappointing, is given to private flying and gliding. The Ministry observes, proudly, that 100 light aircraft, which had become surplus to military requirements, were made available at low cost and sold to the General Council of Associated Light Aeroplane Clubs. During 1946 this latter organization was re-formed under the title of the Association of British Aero Clubs, and 48 light aircraft clubs became affiliated to it. These clubs own about 120 aircraft, and at the end of 1946 there were also 174 privately owned aircraft and 109 maintained for business purposes. Aerodromes are dealt with in some detail and it is rather astonishing to read that at the end of the war there were 700 airfields in the United Kingdom. When the ban on civil flying was lifted in January, 1946, nine airfields which had been used for civil aviation before the war were immediately opened, and by the end of 1947 the number available for civil flying had grown to 133. The report deals with the important airfields outside the London area which have been developed. Reference to airfields in the London area is concentrated mainly on Heathrow which, on May 31st, 1946, was officially renamed London Airport. Some reference is made also to Airport administration, the M.C.A. Divisions, the Scottish Aerodromes Board, and policy on public enclosures and fire and rescue services. Ninety-one existing airfields overseas

NUMBERS OF CIVIL AIRCRAFT ON REGISTER.

	December, 1938			December, 1946			December, 1947		
	Regular Air Transport	All other aircraft	Total	Owned by the Corporations	All other aircraft	Total	Owned by the Corporations	All other aircraft	Total
No. on M.C.A. Register (i)	120	1,546	1,666	347	1,386	1,733	335	2,088	2,423
No. of Registered Aircraft Certified Airworthy ...	100	1,123	1,223	251	782	1,033	275	1,143	1,418 (ii)

Notes: (i) Including aircraft under construction or awaiting Certificates of Airworthiness, and ultra light aircraft. (ii) The figures of registered aircraft certified airworthy for 1947 are provisional.

Two Important Years . . . . .

have been examined together with 10 possible new sites and 15 flying-boat alighting areas, about which, by the end of 1947, discussions had gone far enough for arrangements to be made to begin work. There is an amusing extract from a survey party leader's log book which illustrates the difficulties encountered in making surveys overseas.

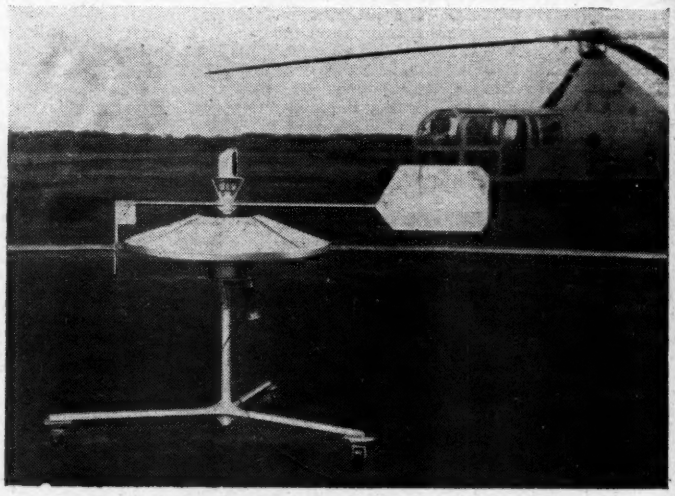
The responsibilities of the Minister of Civil Aviation in the technical field in the years 1946 and 1947 involved a problem having three elements: To build up an adequate operational and technical staff: to take over services and responsibility transferred from the R.A.F. to civil aviation; and to apply new lessons learned during the war to civil requirements The formation of a Provisional International Civil Aviation Organization also made heavy demands on the Ministry. The Minister's technical responsibilities for radio navigational aids, air traffic control services, an aeronautical information service and communication services are dealt with also.

To those interested in international relations in aviation, chapter 5 in the report will be of considerable interest since a review is made of developments in the international sphere from 1944 with special reference to Commonwealth relations and bilateral agreements, and the dates are listed on which bilateral civil aviation agreements between the United Kingdom and other countries were made. The functions and organization of the Ministry are adequately described.

Government expenditure on aviation has increased from £6,792,058 for 11 months of the financial year ended March 31st, 1946, to £15,513,510 18s 7d for the year 1946-1947. The latter was substantially less than estimated, however, owing mainly to expenditure on civil aircraft, works and equipment, which had been incurred more slowly than was expected. The original 1947-1948 estimate provided for a net expenditure of £24,489,500. The most expensive provisions were those for purchase of civil aircraft and associated equipment, works buildings and lands; grants to the three statutory Corporations, ground services for Empire and other routes, and salaries. Some interesting figures are given on the licensing of aircraft and aircrew. Their report finishes with a brief review of Civil Aviation Acts and Air Navigation Acts and Orders, the functions of the Accident Investigation Branch, the Air Registration Board and the Air Safety Board. Appendices include a schedule of the principal services operated and important changes in frequencies on B.O.A.C. routes, the principal internal U.K., Continental and Scottish services operated by B.E.A., and the general development of B.E.A. services during the period, the growth of B.S.A.A. services, and a list of the airfields under M.C.A. control at the end of 1947. There is also a table of British civil aircraft and engines in service and under development, and a selection of new certificates of airworthiness issued in 1946 and 1947. There are also details of operating and traffic statistics by United Kingdom airlines and airfields.

NIGHT-LANDING HELICOPTERS

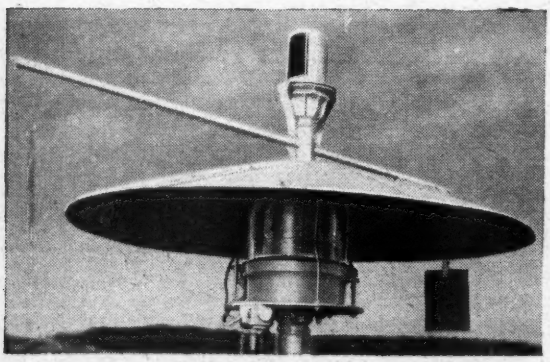
DURING the development flying being done by the Helicopter Experimental Unit of B.E.A., an opportunity has been taken to experiment with special night-landing lights at Westwood Airfield, Peterborough. The requirements differ from those familiar from fixed-wing aircraft operation, and the Unit has evolved various arrangements, one of which is illustrated herewith. It is a combined floodlight and wind indicator designed to give uniform illumination on vertical surfaces over a circle of about 120ft in diameter. It is equipped with a G.E.C. low-intensity approach light fitting mounted 3ft 6in above the ground. An Osram 250-watt class B1 projector lamp has been modified to give its peak intensity at 2½ deg below the horizontal. The conical screen cuts off the light at approximately 3 deg above the horizontal. An obstruction light fitting is mounted on top of the unit.



Experimental night-landing unit with wind-direction indicator.

It has been found that with this unit the texture of the ground can be appreciated from a height sufficient for the pilot to make a good touch-down. A well-defined shadow is cast by the vertical bar on the end of the wind-indicator, the shadow enabling the wind direction to be seen clearly from a distance of about 1,000ft.

The G.E.C. also supplies two low-intensity approach-light fittings for comparative tests to ascertain the most suitable form of beacon for locating the landing area. One was equipped with a red glass dome and an Osram 250-watt class B1 projector lamp, the other with clear glass and a 500-watt Osram class A1 projector lamp. Provision was made for flashing to provide an identification signal. The lamps were placed together in a corner of the landing field, and it was found that they could be picked out against a background of the lights of Peterborough from about two miles in clear weather.



Close-up of unit, showing the G.E.C. low-intensity approach-light fitting under the screen.

Further experiments are being made to solve the problems connected with locating the landing area under conditions of poor visibility. Several schemes are being examined, and it is hoped to establish the most suitable type of beacon after actual trials carried out in bad weather.

The Helicopter Unit is also experimenting with blind-flying equipment for the helicopters themselves, and some interesting results have been obtained.

JET ENDURANCE

WHEN a Northrop YB-49 eight-jet bomber remained airborne for nine and a half hours recently its average ground speed was 382 m.p.h. All eight of its J-35 turbojets were used continuously, except one, which, after 6½ hours, developed bearing trouble and was shut down. It is reported that the alternation in power output occasioned no increase in fuel consumption. Vapour trails up to 100 miles in length streamed behind the great flying wing as it cruised at 35,000-40,000ft. When a full fuel load is carried (including bomb bay tanks) the YB-49 should have a range of over 5,000 miles.

Schiphol

Aer Lingus Dakota "St. Colman" taxies-in to load on the busy tarmac at the Dutch International airport.

The "Airport of the Netherlands," after Complete Destruction, has been Re-established as One of the Foremost in Europe

By Roy Pearl

IT was indeed fortunate for Holland and the international airlines that in 1917 the Dutch Government laid out a military airfield on the site that is now Schiphol airport. That site has been tractable to expansion and general development throughout the period between the wars and is suitable for extensions in the future, even to the most ambitious standards so far contemplated.

Schiphol lies in the north-east corner of the former Lake Haarlem which, in the fifteenth century, was formed by the overflowing of the Rhine and the crumbling away of the banks of the river Y between Haarlem and Amsterdam. It was 18 miles long, 9 miles broad and 14 feet deep. During westerly storms, ships were blown ashore and wrecked in the north-east bay, which became known as 't'Schiphol—the ships' hole. Draining of the lake started in 1840 and was completed in 1853, when a small fort was built in the ships' graveyard, and it was near that fort that the original airfield was laid out in 1917, 14 feet below sea level.

In 1920 K.L.M. started an air service from Schiphol to London and Hamburg with converted military aircraft, and by the following year other airlines were using it as a terminal for Amsterdam, or as a port of call in much the same way that surface transport had used Amsterdam for many years. Six years later, the city of Amsterdam took over management of the airfield, and since that time it has been a municipal airport. Immediate steps were taken to bring landing and other facilities up to date, runways were laid, hangars, workshops, passenger terminal buildings and restaurants overlooking a wide concrete tarmac were built, making the airport one of the best equipped in Europe, and situated in country free from natural obstructions, in an ideal position for an air junction between Central Europe and the West. During 1938, 79,000 passengers, 550 tons of mail and nearly 2,000 tons of freight were handled at Schiphol, and it is significant that Dutch public interest in flying was such that in the same year 36,000 people paid to visit the airport.

On May 10th, 1940, the airfield was bombed by German aircraft and during the occupation it was raided by Allied bombers on several occasions, but the damage was slight compared with that caused by the systematic and relentless destruction by the Germans between September, 1944, and May 5th, 1945, the day of liberation. All buildings were reduced to rubble, sewers were blasted, the grass area was ploughed into deep trenches, and the runways were destroyed by 225 deep bomb craters.

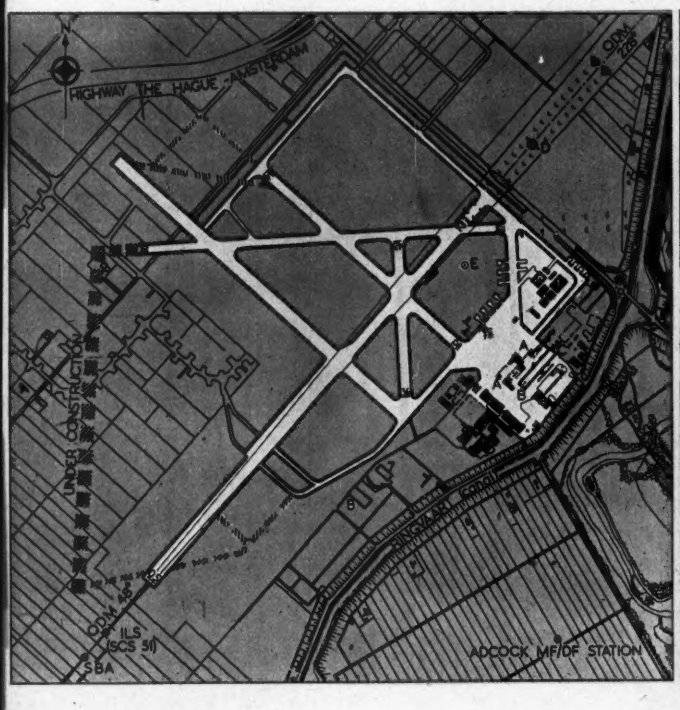
Schiphol.....

The importance of Schiphol to the welfare of the country was, however, appreciated by the municipality of Amsterdam, and reconstruction was put in hand immediately. The first post-war civil aircraft landed during the next July, and by November all runways were in use. Temporary wooden buildings were constructed as offices and workshops, and runway extensions were started, so that on October 8th, 1948, Schiphol was established by the Dutch Council of Ministers and the Minister of Traffic and Power as the International Airport for the Netherlands, suitable for all types of international and national air traffic. Although credit for past development must go to the municipality, in the post-war period the Ministry, which is responsible for all communications in Holland, has given encouragement and financial backing to make reconstruction rapid and adequate. The total grants from the Government already amount to nearly £5 million and the project has now reached such dimensions that a new company with 60 per cent Government interest and 40 per cent Municipal interest will probably be formed to take over full responsibility for the airfield.

Post-war development has taken a definite course, and reconstruction has been planned on a different principle from that for the construction of London Airport. After the runways had been attended to, an apron and hangars were constructed, whilst in the meantime, office and passenger accommodation was provided in caravans and wooden huts. Hangars which had been built by the Germans to resemble Dutch farmhouses at Deelen, a military base near Arnhem, were dismantled and reconstructed at Schiphol, and wooden pre-fabricated hangars were brought from Sweden. At the same time plans were made for building permanent offices, passenger- and freight-handling buildings and modern hangars to make the airport suitable for international traffic over an interim period up to about 10 years. Construction was to be such that those interim buildings should fit into that ultimate scheme for the airport which would place it on an equal standard of efficiency with the best airports in the world. In this long-term plan, the interim and ultimate runway design represented the most critical problem.

Although the interim scheme will not be completed until the end of 1950, the terminal buildings are now well under way, and passengers will soon cease to be accommodated in austere wooden hutments. The plan includes a five-storey, all-glass control tower and accommodation for fire-fighting and emergency equipment. The main terminal building is divided into separate sections for dealing with all arrivals from abroad; transit passengers; departures for Europe; departures for transatlantic and inter-Continental routes; freight and mail; and also to provide offices for all services, and for K.L.M. and the foreign airlines. The whole is on ground level, with the exception of comfortable and exquisitely decorated restaurants on two floors in the centre of the building, overlooking the apron. Along the whole 750ft frontage is a roof promenade for visitors. As sections become available for use, so the huts are being taken down from the apron (131,560 sq yd) to provide greater movement area for aircraft.

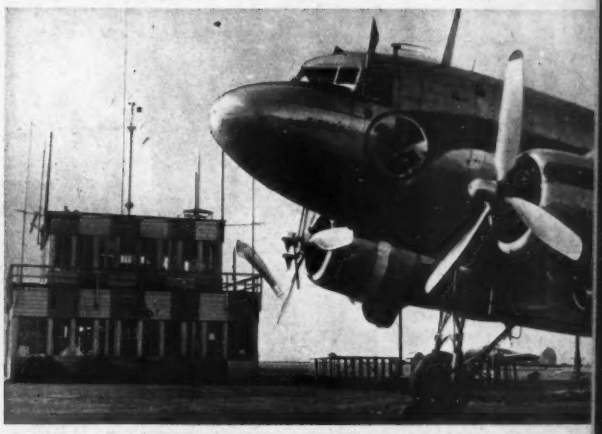
The north-south runway is nearly completed, and the airport will then be capable of accepting aircraft up to 200 tons gross weight. Runway 230-050 is in the direction of the prevailing wind, measures nearly 2,500 yd and is equipped with S.B.A., I.L.S., and Schiphol's own Course-and-Bearing system of approach, which has proved popular with many captains using the airport. It may be described as a "semi-talk-down" using radio bearings, and is worked in conjunction with a non-directional holding beacon north-east of Amsterdam. In QBI conditions, aircraft home to this beacon and fly the holding pattern at stacked height,



A recent photograph of the apron and new buildings. The [illegible] can be seen at the top left.

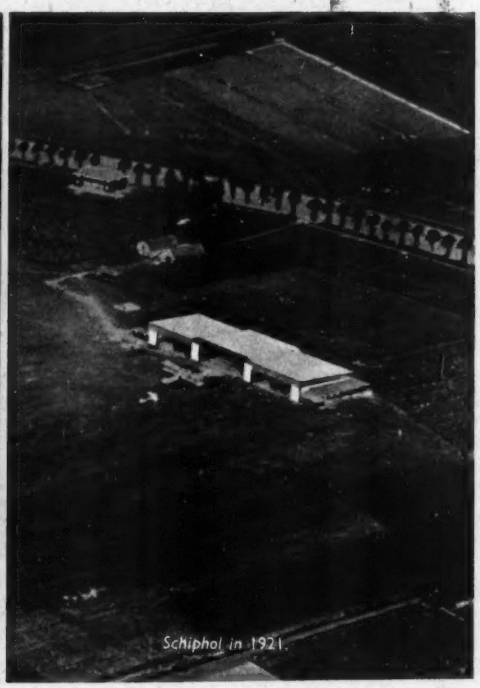
Airfield sketch legend: 1-8 Hangars. A = Temporary accommodation. B = Terminal building. C = Conrol tower. D = Direction finding station. E = Non-directional beacon.

Visitors watching aircraft from the roof cafe of the new terminal building.



On the edge of the apron stands the crowded temporary Control Tower.

...or can be seen near the



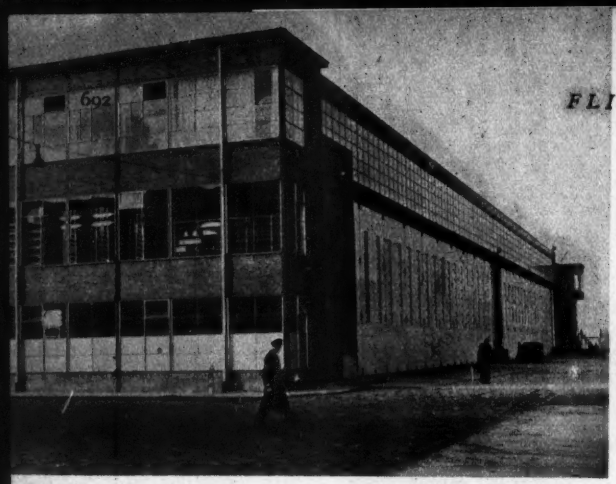
Schiphol in 1921.

until directed to land. During the approach on QDM 228 deg M. starting from the holding beacon, which lies at 048 deg. M. from the runway, cross-bearings on the aircraft are taken by a D/F station 4 miles from the beam. These bearings are then passed to D/F station marked D on the accompanying sketch, which is situated in the direct line of approach and 800 metres from the runway boundary. Station D also takes bearings on the aircraft and passes both "course to steer" and "distance to go" by R/T, to the captain. The captain must know his required rate of descent, which can be checked as in SBA, on outer and inner marker beacons. A further check occurs when the aircraft passes over station D, for the captain hears the engines of his own aircraft on R/T as it flies over the station. BABS and GCA have been applied for. In addition to normal airfield and approach lighting systems, the approach to runway 230 is equipped with two parallel rows of red neon tubes for bad visibility conditions.

Air traffic throughout Holland from the German border to Belgium, north to 55 deg N and west to 2½ deg E, is controlled by ATC Schiphol for height and direction to fly (there are no traffic lanes) and aircraft bound for the airport must go over, five minutes before arrival at the homing beacon, to Aerodrome Control under VFR or Approach Control under IFR. Navigation assistance is provided by homing beacons, one of which, situated 4 km north-west of the airport and transmitting continuously on 260 kc/s, is used in conjunction with radio compass. There is also MF D/F, VHF D/F R/T on four channels and MF W/T on the European wavelength 3997. There is a teleprinter service to the immediately neighbouring Control Regions.

The entrance to the Arrivals Hall, and in the background the two-storey restaurant.

The new Control Tower has a commanding view of the airport.



Office accommodation at both ends is a feature of the K.L.M. hangars.

Foundation of the new runway in the clay soil of the dried-up lake penetrates to a depth of one metre. Layers reading from top to bottom with thicknesses are: Asphalt-Concrete 5 cm.; Packed Stonebase 25 cm.; Vibrated Sandbase 35 cm.; Rolled Concrete 30 cm.; Sand 5 cm.

Schiphol.....

K.L.M., the national airline, has established its home base at Schiphol Airport, and, in conjunction with the municipality, buildings for a vast maintenance organization are being constructed. These, although designed to the airline's requirements, will be occupied on a rental basis. Similarly, office accommodation in the terminal building will be occupied to a greater extent by the Dutch airline than by those of other nationals, but again on a rental basis. Schiphol is used regularly by AOA, SAS, Air France, B.E.A., the Czechoslovakian airline CSA, Sabena, Swissair, Aer Lingus and the Finnish airline Aero O/Y. In addition, aircraft of some 50 charter companies call at Schiphol every month. Private owners have also found it a convenient airport, and military aircraft from European countries and the U.S.A. have from time to time landed there. During last August the total flight movements were 6,456 and the highest ever recorded in any one day was 556 on November 16th, last year. During the summer there was an average of 100 daily movements by scheduled aircraft; nearly 90 on testing, instruction and other K.L.M. flights; 9 charters and 22 miscellaneous, making a total of some 220 per day. Since November 1st the daily number of scheduled arrivals and departures are as follows:—

Number of Arrivals.

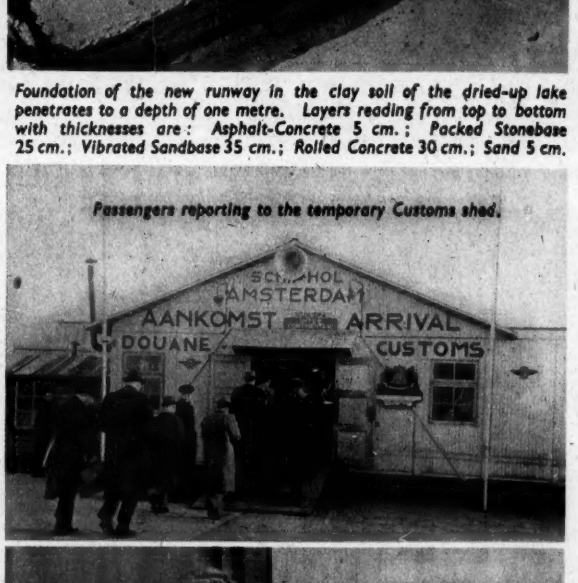
Mon.	Tue.	Wed.	Thu.	Fri.	Sat.	Sun.
26	31	33	28	32	32	19

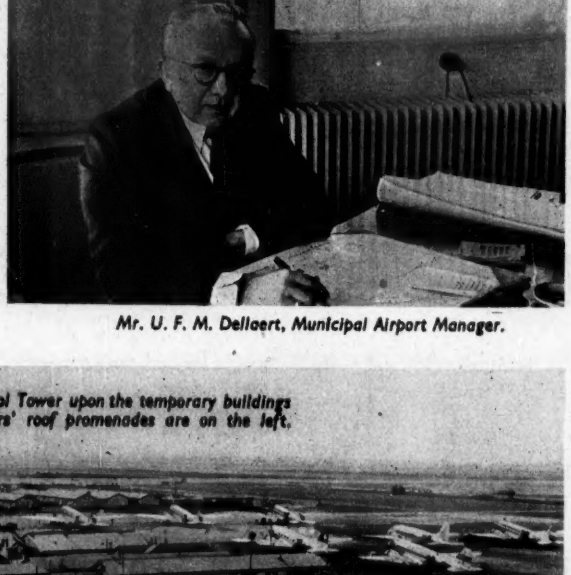
Number of Departures.

Mon.	Tue.	Wed.	Thu.	Fri.	Sat.	Sun.
28	29	32	29	31	33	19

From Schiphol, domestic routes radiate to Leeuwarden, Groningen, Enschede, Eindhoven and Maastricht, and Continental services fly throughout Europe and to Scandinavia. Trunk routes penetrate to the Middle East and beyond to Batavia daily in each direction, and across the Atlantic

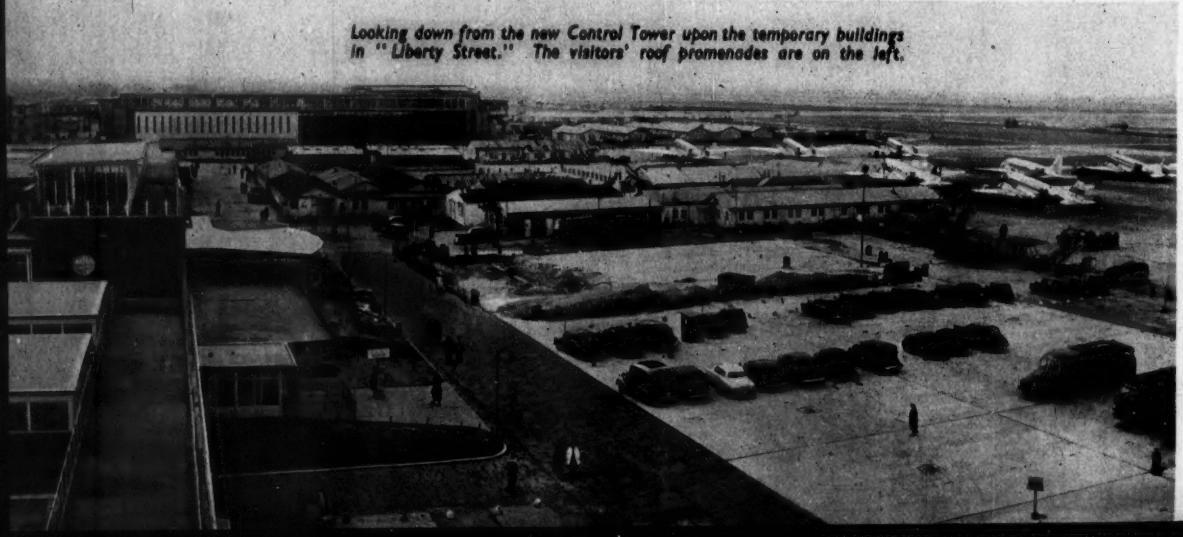
Passengers reporting to the temporary Customs shed.





Mr. U. F. M. Dellaert, Municipal Airport Manager.

Looking down from the new Control Tower upon the temporary buildings in "Liberty Street." The visitors' roof promenades are on the left.



Schiphol . . . . .

to New York, Curacao, Natal, Rio de Janeiro and Montevideo. On scheduled transatlantic and inter-Continental routes, 64 Constellations or Douglas DC-6s and DC-4s take off each week for one of those distant destinations. Passenger and freight figures at Schiphol for 1948 were:—

	Europe	Transatlantic Inter-Continental	Domestic
Passengers	144,346	41,232	34,455
Freight (tons)	2,650	1,140	900
Mail (tons)	757	570	—

During 1947 604,200 people visited the airport, and this year 500,000 had visited it by August 10th.

Behind this truly outstanding post-war recovery, and at the head of negotiations for future planning, is an air-minded municipality supported by the Government and spurred on by the rapidly expanding national airline, K.L.M., which is, of course, very closely connected with and consulted in the plans for developing the airport. There is one personality, however, who is the co-ordinator and enthusiast behind the scheme. He is the Airport Manager, Mr. U. F. M. Dellaert, who has served at Schiphol for 28 years. He was a military pilot from 1916 to 1920 with Dr. Albert Plesman, with whom he went to K.L.M. after the war, in the days when Schiphol was first being used for civil purposes. He is behind the long-term plans already mentioned, which the Municipality and the Government Aeronautical Service together have produced in detail; it now only remains for the Municipality Council and the Minister to agree to them. The present interim scheme will then become part of the whole, and eventually this north-east corner of the dried-up lake will become the technical site, while passenger-handling will be conducted from very much larger premises, probably in the centre of the runway system.

While it is not possible to forecast for certain what system will eventually be adopted, it seemed probable from our own observations that a tangential pattern was favoured. It is certain that such a scheme could be developed from the present layout, and extensions could be made in the north-westerly direction. Total cost for the eventual plan will be some £15 million, and when it is completed in ten years' time Holland will undoubtedly have a vast, fully equipped modern airport capable of taking the largest contemporary aircraft at reasonable frequencies.

PRESTWICK CRASH INVESTIGATION

THE Minister of Civil Aviation has appointed Mr. Thomas Pringle McDonald, K.C., to hold a Court Investigation into the accident to the K.L.M. Constellation which occurred near Prestwick on the night of October 20th. This investigation is to be held in the Sheriff Court House, County Buildings, Ayr, and will begin on January 10th, 1949. Capt. Frost, B.O.A.C., has been appointed Assessor, and the case will be presented by a Scottish lawyer on behalf of the Crown Agents, the Scottish counterpart of the Treasury Solicitor.

MALTA'S PRIVATELY OWNED AIRLINE

AFTER two and a half years of pioneer work in civil aviation in Malta, an official licence has been granted to Air Malta, Ltd., authorizing them to operate scheduled airline services between Malta and North Africa and Sicily, and also a scheduled stopping service between Malta and Rome. This is the first licence of its kind to be issued to a private aviation company in Malta not operating in association with one of the British nationalized airways; Malta Airways, Ltd., to which reference was made in *Flight*, November 25th, is an associate of B.E.A.

Air Malta came into being in May, 1947, as a result of a merger of three companies which had been operating aircraft from the Island since early 1946. The first of these companies, British Aviation Services (Malta) Ltd., was formed as a subsidiary to British Aviation Services, London, to handle and service private aircraft passing through Malta, and also to charter aircraft from the U.K., thus enabling passengers wishing to travel from Malta to do so without having to obtain high Government priority which was at that time necessary. Shortly after the formation of British Aviation Services, a second company, Instone Airlines 1946 (Malta) Ltd., was formed to help deal with the passenger congestion then prevailing in Malta. The third company, Chartair, Ltd., in November, 1947, sent aircraft to Malta, for the use of Instone Airlines and to work side by side with aircraft which British Aviation Services had then based at Luca. The object of these companies was to establish services on a charter basis for flights from Malta to the surrounding cities, chiefly Rome, Naples, Catania, Palermo, Tunis and Tripoli. Owing to the amount of public support which these charter companies received they were reorganized on a semi-scheduled basis, and since there were no other services available from the island, the Maltese Government permitted them to continue until such time as a licence could be issued.

In 1947 the three companies were formed into one unit under the name "Maltairline," and applications for licences to run services were made to the Italian and British Governments. Since the original applications were made Air Malta, Ltd., the company formed from the merger of the three companies, has carried over 10,000 passengers, flown approximately 4,000 hours, and covered a distance of 520,000 miles. In addition 120,000 lb of freight and 10,000 lb of mail have been handled.

The company has found it extremely difficult to purchase new feeder aircraft, and says that up to date no suitable model has been found with a seating capacity of eight to ten persons which in the company's opinion has an economical running cost. However, the management is at the moment considering purchases of the Dove or the Prince, and are watching the performance figures of these aircraft with other airlines. Since Air Malta is a privately owned company running entirely without grants or subsidies, it is of paramount importance that any aircraft purchased should be an economical proposition. Aircraft such as the Viking are not considered suitable in view of the short distances of the routes operated, for which the Viking's operational costs would, they consider, be high. Until such time as new aircraft are purchased, Air Malta will continue to use the Airspeed Consul, which they have found reliable and satisfactory.

AMALGAMATION OF BLACKBURNS AND GENERAL AIRCRAFT

FOLLOWING the amalgamation of General Aircraft, Ltd., and Blackburn Aircraft, Ltd., announced in *Flight*, December 2nd, the names of the companies will be changed: General Aircraft becomes Hanworth Securities, Ltd., and Blackburn Aircraft, Ltd., becomes Blackburn and General Aircraft, Ltd. General Aircraft production at present in hand at Hanworth will be completed there and it is therefore impossible to say when production will finally be centralized at Brough. When this does occur, however, some redundancy is likely to arise at Feltham and it is expected that from February, 1949, there will be progressive releases of work people from Feltham. The Ministry of Labour, the company and the appropriate trade union organizations and shop stewards are formulating plans to find alternative employment for the people released. Among the other objects of the amalgamation scheme aimed at are a combination of the best administrative technical and production ability of both companies in a single undertaking. Furthermore, by transferring the aircraft production to Brough a step will be taken to reduce undesirable concentration of the aircraft industry in the London area. The Minister of Supply is said to be in general agreement with these objects of the scheme. In any case inadequate airfield facilities at Hanworth would have rendered necessary the transfer of General Aircraft, Ltd., airframe production in the near future.

In an address to be made at the annual general meeting of Blackburn Aircraft, Ltd., on December 20th reference is made to the reorganization of the Board of Directors. It is proposed that Mr. H. V. Gort, managing director of General Aircraft, Ltd., should become a director of Blackburn and General Aircraft, Ltd., and it is further proposed that Mr. Gort and Capt. M. W. G. Blackburn should become joint managing directors in place of Mr. R. Blackburn and Major Bumpus. It is expected that these changes will be effective as from January 1st, 1949. Such an arrangement, however, involves a breach of the contract between Blackburn Aircraft, Ltd., and Mr. R. Blackburn and, in these circumstances, a resolution for the payment of £12,500 representing approximately the salary and estimated commission on profits for one year which Mr. Blackburn would be entitled to draw under his agreement, is to be submitted to the members for their approval. Though Mr. R. Blackburn will no longer be joint managing director he will remain on the Board as Chairman of the new company.

Helicopter Problems

Discussion of Five Papers at R.Ae.s. and H.A. All-day Meeting

SUMMARIES of four of the five papers read at the joint meeting of the Royal Aeronautical Society and the Helicopter Association of Great Britain on November 20 were published in *Flight* of November 25th, and last week we dealt with Mr. Shapiro's paper on the Cierva Air Horse. The papers were discussed at one session in the morning, one in the afternoon and one in the evening.

The discussion of W/C. Brie's and Capt. Liptrot's papers was opened by MR. W. TYE, who said that in spite of feeling an innocent abroad, he must not be deterred from making a quixotic tilt at all the windmills he saw around. His engineering instinct rebelled against the many different configurations, but he did not propose to suggest what a helicopter should look like.

Mr. Tye pleaded for efficiency and safety to be developed hand in hand in spite of the fact that the two would pull in opposite directions. The only satisfactory way would be to get much operational experience as quickly as possible. As examples of things we wanted to know he quoted the loads applied by pilots in manœuvres; means to determine fatigue conditions for blade design; the velocity of descent in normal and emergency landings; the use of engine power in typical flights; the effect of ice on rotor blades; and the degree of stability necessary for safety. Having served on A. R. B.'s Helicopter Committee he knew how difficult it was to prepare a design code in the absence of this sort of information.

MR. O. L. L. FITZWILLIAMS, acting on the principle that contradiction was good for discussion, accused the authors of the first two papers of grumbling too much about the shortcomings of the helicopter. All the main complaints had been of a minor nature, and the main hold-up in helicopter development was lack of funds and of experienced aircraft engineers. The mechanism was reliable, and as for maintenance, the inspection schedule called for was out of all proportion to the trouble actually found. Some major parts of one helicopter were not dismantled for inspection over a period of 600 hours.

Lack of stability was not serious in view of the use to which the helicopter was being put. It would be provided by the time it was needed. What was necessary was money, and that had to come from the customers.

MR. L. S. WIGDORTCHIK said there was no military incentive to helicopter development, and therefore they had to produce helicopters which could be made a commercial success by an efficient operator. Contemporary helicopters cost too much and did not carry enough far enough in a given time. He thought there was no need to follow fixed-wing practice for undercarriages, structure, etc. He believed that great advance in commercial characteristics could be obtained with the very large helicopter in the 1,500-2,000 h.p. class. History showed that vehicles became really economic only when man evolved his society around their potential.

City Landing Sites

AIR COMMODORE H. PRIMROSE thought the lecturers had failed to deal with two of the problems stated by Mr. Masefield in his Empire Lecture: efficient ground organization, and an air-faring outlook by the public. It was no use developing the helicopter if, by the time it was a satisfactory machine, there were no developments of city centre landing sites. Without them, the advantages of the helicopter could not be reached. As for the air-faring outlook, he recalled the good work done by Alan Cobham. He thought we should develop alighting gear which would save a lot of weight and drag, and, by spreading the load, reduce the bearing-strength requirements of landing sites. If of air pressure type, it might enable the helicopter to operate from water. With the helicopter, much time could be saved by a quick turn-round.

MR. S. SCOTT-HALL was glad to hear Mr. Fitzwilliams promise that stability would be forthcoming when it was wanted, but at present the helicopter impressed him as being as unstable as a billiard ball balanced on a pin. He hoped two subjects in particular would be dealt with in the discussion: stability and blind-flying ability.

MR. A. McCLEMENS criticized present maintenance methods. We pulled the machines to pieces for inspection at certain periods and put them together again, often doing more harm than good, and the result was that for every hour a helicopter spent in the air, it spent 2½ hours on the ground being tinkered with. That figure bore no relation to the actual reliability of the machine, and was due to lack of knowledge of the mechanism, so we must find out the hard way. The designer must give the operator maximum possible utilization potential for the minimum engineering effort. We should abandon the present system of discovering defects by looking for them, and the manufacturer ought to find out what the lives of his components were, so that the operator could leave them alone until their lives were over, and then change them. Close attention should be paid to interchangeability and accessibility, and to provision of special tools for servicing.

MR. H. FENNESEY stressed the navigational differences between fixed-wing aircraft and the helicopter. The helicopter had to land in a small space, probably approached by a devious route. Navigational aids must be of minimum weight and entirely automatic. He welcomed the realization of this among helicopter people, and said his firm was working with B.E.A. on an entirely automatic solution based on radio information which was automatically compared with the track it was desired to follow. The result was fed to the pilot electronically, in terms of his position to left or right of track, distance from track (in miles or yards), and distance to destination. The B.E.A. Helicopter Development Unit had flown with that system, and a practical solution of the problem was within easy reach.

Replacement Costs

In the afternoon, after Dr. Bennett, Mr. Hafner and Mr. Shapiro had read their papers, MR. A. DAVENPORT opened the discussion. He pointed out that probably the helicopter could render the sort of service that could be run at loss, or without profit, provided the whole organization of which it formed a part was run at a profit. Improvement in horsepower per passenger (at present about 75) might be attained by better design and construction of rotor blades. He did not agree with Capt. Liptrot that real replacements were excessive. In the S.51 there was a major inspection at 400 hours, and the replacement cost was less than £100. That was remarkable in a machine which had been used for demonstrations and that sort of thing. Better fuel consumption was wanted, and he thought designers might pay more attention to streamlining. But the helicopter had already proved its practicability over many thousands of flying hours, with excellent reliability and easy maintenance.

MR. NORMAN HILL, as a would-be operator of British helicopters, asked designers to give operators a helicopter which could be operated at a profit. There was as yet no British helicopter which had a full C. of A. Insurance; underwriters quoted harsh rates. At State airfields landing fees were heavily against the type, although the wear and tear it caused was negligible. He advised manufacturers to *seal* their machines as soon as they were practical propositions, and they should then go to operators for the proper operational testing necessary. To insurance people he would say: do not burden this promising aircraft with heavy rates without regard to the safety features clearly seen when the helicopter is in the hands of airline operators with an appropriate technical and financial background. To the legislators he would say: frame your regulations with wisdom and vision so as not to hamper this new vehicle in its development.

MR. G. A. FORD, speaking as a pilot, said he would like to see some form of manual control which would give a cushioning effect in a vertical landing, and which would also increase pitch to compensate for loss of engine power with altitude. Attention should be paid to instrument panel layout, and blind-flying instruments should be in front of the pilot and close together, even at the sacrifice of a little of the forward view.

MR. ROBERTS thought the authors of the papers had said a lot about the causes of helicopter problems but little about solutions. Many of the solutions suggested were not really solutions at all. Stability could only be achieved through really hard work by a team. We had many experts but no teams on the scale required. In America it was different, and he thought we should be behind America for a long time. Stability in hovering flight was difficult to achieve, and he felt it was begging the question to say it was not wanted.

MONSIEUR P. RENOUX, a French visitor to the meeting, referred to the SNCASE helicopter with twin tail rotors, and

said this arrangement gave good control and stability in pitch and yaw. He had brought a film which it had been hoped to show, but the projector could not be persuaded to work, and M. Renoux was asked to leave the film with the R.Ae.S. to be shown another time.

MR. G. E. CLAIR welcomed Mr. Hill's reference to insurance. Those interested were anxious to learn as much as possible. They would particularly like to know about the possibilities of autorotation for making safe landings without engine. The harsh insurance rates were the result of bitter experience in America and on the Continent.

Safety Problems

MR. J. K. WILLIAMS said the helicopter had now achieved a basic and successful configuration. During the next few years, designers must concentrate on safety and on improved efficiency. There were five major problems in attaining safety. A great deal of simplification was needed. We must make sure, from laboratory tests, that all parts such as gears, bearings and rotor blades would remain airworthy. Extensive flight testing with strain gauges was needed to reveal the loads experienced in flight manœuvres. The most serious problem was the failure of a rotor blade in flight, and much research would be needed. The single-engined helicopter was far safer than the single-engined fixed-wing aircraft, but a danger zone did exist. He agreed that future helicopters on scheduled services would have to be twin- or multi-engined. There was also need for reducing disc loading, a need which was contrary to the desire for greater payload. The blind-flying problems were being tackled by the B.E.A. Helicopter Unit, and he thought a satisfactory solution might be expected in the near future.

DR. A. P. THURSTON advocated the use of models for solving helicopter problems at low cost. Models could be controlled by means of cables, which enabled one to control pitch, collective and differential, and much else.

MR. YATES was interested in narrowing the range of danger heights in case of engine failure. At less than 300ft there was insufficient time for the pilot to get the rotor into autorotative pitch. The blades should be designed to change automatically without time lag. In conclusion he pleaded for more specialized discussions on various helicopter aspects.

MR. ANDERSON pleaded for an examination of the convertible type of aircraft, in which very large airscrews are used as rotors for take-off and for normal horizontal propulsion when operational height has been gained. For a given engine power, the convertible could show less than half the drag-producing area, which meant greater speed.

GROUP CAPTAIN GIBSON thought the difficulty of flying helicopters had been exaggerated by fixed-wing pilots. One of the great difficulties at the moment was that there were no real facilities for learning. He suggested that a familiarization course should be established at which a five-hour course could be taken at low cost.

Autorotational Landings

SQUADRON LEADER F. J. CABLE advocated a middle course. We should not regard helicopter piloting as the work of supermen, but we should not say they are easy to fly. There was no difficulty about the engine-off landing problem. At Beaulieu they had carried out some 500 such landings successfully. That was with the R.4, and presumably later machines would give better results. They had landed in still air, at 2,800 lb weight over a 100ft screen in 25 yards, not as a stunt but repeatedly. The insurance people could say that a helicopter could be landed safely, depending on circumstances and the skill of the pilots. Given a stable helicopter, blind-flying could be practical with the development of one or two instruments.

MR. W. N. EVANS thought too little had been said about helicopter power plants. There was a case for a modified method of rating. Helicopter designers needed power for hovering (some 90 per cent of maximum), a power higher than that for emergencies, and some optimum power cruising rating. He had found difficulty in getting information, but it did appear that helicopters would take a greater percentage of maximum power for longer periods in relation to total flight period than did fixed-wing aircraft, and that r.p.m. would have to be narrowed down within a tight range just below max. permissible r.p.m. He would like to know if helicopter efficiency was likely to be improved so that such large percentages would no longer be demanded.

GROUP CAPTAIN HOWARD had had high insurance rates quoted to him; and enquiries in America had revealed that more than 80 per cent of accidents were not due to any fault in the helicopters but to damage of tail rotors by pilots striking hedges when getting into corners for crop spraying. It was hardly fair that we should be penalized for the irresponsibility of some American operators.

MR. N. E. ROWE, in summing-up the discussion, thought that on the whole the designers had dealt reasonably well with the points brought up by the operator and technical expert. Safety was, perhaps, best achieved by having multi-engines. Reliability included maintenance, blind-flying, stability and control, and all-weather operation. Navigation was important.

In this country we particularly needed blind-flying ability with complete precision. He urged that we should make the best use of what we had got, and regretted more had not been said about helicopter sites. He thought there had been a tendency to over-emphasize the importance of vibration, although it was important to reduce it in order to get high forward speed and thus better economy.

The five lecturers then replied briefly. W/C. BRIE said he had deliberately assumed a Jekyll and Hyde dual role. His criticisms had arisen from close association with modern American equipment. To encourage British industry, B.E.A. had undertaken to study helicopter operation so as to discover problems and difficulties. If British firms could produce something like the equivalent of what we were using now, the economics would sort themselves out. They could not obtain the basic knowledge unless they had the goods to handle. He agreed with G/C. Howard that there was no need to base insurance rates on American experience. We in this country knew a thing or two, and were open to talk to anyone interested. During a year's operation in B.E.A. they had not had to replace even a split pin as a result of accident. That was a fact—and a record. As for ease of flying, there was never a machine so easy to fly as the Cierva Autogiro. In the helicopter we had thrown away some very good points, and it was necessary to retrace our steps a little.

Casualties Few

CAPT. LIPTROT said they were using equipment now available, and from their experience trying to point the way. British designers were aiming at long life of working parts, which should mean low maintenance cost. Reference had been made to insurance. He pointed out that in the whole of helicopter development, only seven people had been killed, and the helicopter had saved more than 100 lives. By giving constructors the incentive to get production lines going we should get machines on the market; more would then be sold, and down would come the price.

DR. BENNETT recalled having seen a Sikorsky land safely from 50ft with engine failure. The only damage was a bent nosewheel. To guard against the pilot not being able to take the proper action, it was advisable to incorporate low pitch and low disc loading. It was hoped eventually to make use of the kinetic energy of the rotor. The problem of automatic pitch had been tackled in the Gyrodyne. The over-riding manual control would satisfy most pilots.

MR. HAFNER thought stability would not be attained with a gadget. Stability in forward flight could be obtained with a tailplane. In hovering flight the pilot had in any case to have very accurate control to maintain his position in relation to a point on the ground and would not miss stability very much. As for blade fatigue, he thought the ultimate solution would be monocoque blades, but that was a very specialized form of construction.

MR. SHAPIRO thought some of the details had assumed disproportionate magnitude in the discussion. Many present shortcomings were accidental and would be taken care of by better engineering design. He would like operators to tell him how much performance he would be allowed to lose for every hour's maintenance saved in 100 hours of flying. No one who could not answer such questions in a quantitative way should express their views. The Air Horse undercarriage entailed less sacrifice in weight than if an attempt had been made to provide extra kinetic energy in the rotor by increasing the tip speed.

EXPERT OPINION

SPEAKING in Canada, A. Cdre. Sir Frank Whittle expressed the opinion that there were no serious obstacles to the immediate introduction of turboprop-powered airliners. He disclosed that six British firms today had about 16 types of aircraft gas turbines in production, or in advanced stages of development, of which eleven were still on the secret list. Sir Frank said that he believed the three things most needed in the world today were a common language, a world-wide high standard of education, and more rapid advances in communication. The third, of course, should help bring the first two together.

Development of the Mamba

Reduction Gear, Compressor, Combustion Chambers and Controls

LAST week reference was made to a lecture by Mr. W. H. Lindsey, M.A., A.F.R.Ae.S.,* delivered before the Royal Aeronautical Society on November 25th, and mention was made of the conception of the Mamba and also of the latest development of this small turboprop, the more powerful Mamba 2. Milestones in the development of this Armstrong Siddeley power unit are now summarized and Mr. Lindsey's lecture is reviewed in more detail below. A description of the Mamba, illustrated with cut-away drawings in colour, appeared in *Flight* dated March 18th, 1948.

The project design was completed in the autumn of 1945, the diameter being only 27in compared with 50in for the piston engine in place of which it was designed and the weight 650 lb compared with 980 lb. In April, 1946, the first engine, weighing 707 lb, was installed on the brake for its first run. The first runs were disappointing, largely because of compressor troubles. A radical mechanical change was made to incorporate a centre bearing, and the engine first achieved a power figure approaching its design value—1,013 s.h.p.—in December, 1946. Reduction gear troubles were largely overcome by May, 1947, and the problem of developing a combustion system which would last long enough to complete a 150-hour type test next engaged attention. In October, 1947, an engine was installed in the nose of a Lancaster flying test bed, and the problem of providing a satisfactory method of control in flight was tackled. In February, 1948, a Mamba engine successfully completed a final 150-hour military and civil type test, and in July made a special 500-hour endurance run. Mambas are now flying successfully in the Balliol and Athena trainers, and civil versions have been installed in the Marathon and the prototype Apollo. Running to date totals over 5,000 hours, of which well over 100 hours has been done in the air.

MR. LINDSEY commenced his detailed description of development by reviewing the main features of the Mamba in its original form, and mentioning the principal alterations made. Originally, the rotor was mounted in two bearings, a double-angular-contact ball-thrust-type bearing at the front of the compressor and a single-roller bearing immediately forward of the turbine. The reduction gear had been driven by way of a quill shaft from the front end of the compressor, and had consisted of a straightforward compound epicyclic gear. Two major alterations to the original conception of the engine proved necessary, said Mr. Lindsey: (a) the incorporation of a centre bearing; (b) the modification of the reduction gear to eliminate teeth meshing frequency vibrations.

Regarding the incorporation of a centre bearing, Mr. Lindsey said that fouling of compressor blades on the casing was experienced at the high-pressure end of the compressor, and this was originally thought to occur because of whirling of the rotor drum assembly at high speed due to rotor out-of-balance. However, it was found that the trouble occurred immediately after a shut-down, and it became apparent that while stationary after a run the normal rise of hot gases to the upper half of the engine caused a sufficiently large temperature difference between the top and bottom of the engine to cause the stator assembly to bow.

REDUCTION GEAR

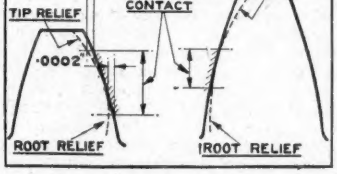
THE next obstacles in the way of trouble-free mechanical behaviour were associated with the reduction gear. Fortunately, many lessons had been learned from Python experience which was being obtained during this period and the problem could be tackled with confidence. As originally designed the gear was a compound epicyclic gear, the sun gear of which was driven by a quill shaft from the front end of the compressor and had 16 teeth. The sun gear meshed with three planet gears, each having 35 teeth, which were mounted in roller bearings in a built-up planet cage, the front half of which incorporated the airscrew shaft. Integral with the planet gears were three satellite gears having 15 teeth which meshed with a stationary internal gear having a ratio of 0.113:1. In the first instance all teeth were of the stub type. The 54-tooth internal gear, although prevented from rotation, was not fixed.

Vibration troubles were soon apparent during early Mamba engine running, with the usual symptoms of fatigue failures of compressor blades, tabwashers and the gears themselves, and severe fretting of all the mating surfaces in the torquemeter mechanism. Trouble was encountered especially in the internal gear which failed adjacent to the torquemeter sockets.

Critical examination of the natural frequencies of the failed components showed the trouble to originate in the tooth meshing. During the meshing of two gears of the type used, the load for a time is carried solely on one tooth in each gear. The load carried causes the tooth to deflect and hence the teeth just about to come into mesh are slightly out of pitch and therefore, when they do engage, there is a distinct shock which can cause a vibration of tooth meshing frequency. The cure is to relieve the gears at the tip and root, thus forming a wedging action on engagement. This relief, however, effectively alters the profile of the tooth, which is no longer of true involute form.

Thus, if the relief extends into that portion of the tooth which is carrying the load during the period of single tooth contact, the angular velocity of the driven gear cannot remain uniform. The accelerations caused by this factor are such as to involve enormous loads and, in fact, the discrepancies are taken up by further tooth deflection accompanied by vibration.

In some earlier work a cure was found by substituting full-depth teeth for stub teeth. The illustration shows how this



Substitution of full-depth teeth for stub teeth enables relief to be applied without altering the involute form over the region of single tooth contact.

substitution enabled relief to be applied to full-depth teeth without altering the involute form over the region of single tooth contact. By retaining correct tooth form in this region and just the right amount of correction outside, vibration could be eliminated. Any errors would introduce some vibration and its intensity will vary with the square of the tooth meshing frequency. As this frequency for the sun gear train in the Mamba was very high it was thought that gears could not be made accurately enough to eliminate trouble in this train by resorting to full-depth teeth. The tooth meshing frequency was 3,430 cycles/sec.

Accordingly, full-depth teeth were used in the second or internal gear train only and the sun gear train was redesigned, using single helical gears for sun gear and planets.

Apart from purely manufacturing difficulties, the use of helical gears had introduced the problem of absorbing thrust loads on both the sun and planet gears.

The whole of this gear development occupied over three months and was eventually entirely successful. The lessons learned have enabled similar gears to be designed which have worked first time. It was now believed that the principles of high-speed gears of this type were fully understood and that this problem, which was once quite rightly deemed to be the big "if" in turboprops, had been permanently solved.

THE COMPRESSOR

NEXT, the lecturer discussed compressor design, stating that the reason for the decision to concentrate on axial compressors was that there were indications that they should be more efficient than centrifugal compressors, and that they were fundamentally a better shape for inclusion in an aircraft engine (smaller diameter and greater length).

Of the Mamba compressor, he said that at first the stators had been shrouded at the tips, air being prevented from leaking back across the stator row by controlling the axial clearance between the stator shrouds and the ring formed by the rotor blade platforms when assembled in the discs. Experiment had shown that, in general, the shortest compressor, i.e., the lowest axial spacing of blades, was the most efficient.

In many aspects the Mamba design was a radical departure from that of the earlier A.S.X.; mechanically, the rotor was of the disc type, but aerodynamically it became a drum-type one. This construction was light and stiff, and allowed for the higher rotational speeds. The blading design itself was of the medium stagger type. For ease of manufacture the stator blades were made with untwisted sections which led to blading approximating closely to what is known as half vortex blading. This term merely means that the tangents of the air angles at any point are the arithmetical means between those which would obtain for free vortex design and those which would obtain for constant reaction design.

On the first run the compressor performance was so disappointing as to preclude any possibility of the engine working without a radical improvement. The maximum compression ratio at full speed was nearer $3\frac{1}{2}$:1 than 5:1.

A serious review of the whole compressor design was undertaken and it was decided that the only feature of the compressor which could be causing such a catastrophic

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* *Mr. Lindsey is Assistant Chief Designer of Armstrong Siddeley Motors, Ltd.*

Development of the Mamba

loss in performance was the design of the stator blade shrouds. The theory was that the axial sealing of these shrouds was inadequate and that the re-circulation around the very small stator blades was completely upsetting their performance. Modification caused an immediate and heartening increase in performance, and in one stride the compression ratio was increased from 3½: 1 to something over 4½: 1.

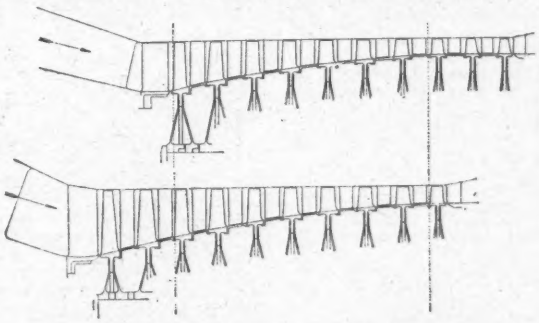
Stage-by-stage performance calculations and measurements showed that the remaining discrepancy was caused by the inadequate pressure rise in the last stages of the compressor and these were cured quite quickly. Within three months of starting work on the investigations the compressor was producing its design performance.

The success of the experimental work on the Mamba compressor had given encouragement to seek further improvement. The design of the compressor with the last four stages of equal height had suggested a simple method of increasing the throughput of the compressor with consequent increase in engine power. The scheme suggested was to design two new low-pressure stages to be inserted in front of the compressor, and to remove the last two stages, thus maintaining the compression ratio, increasing the outlet velocity and effecting a theoretical increase of 26 per cent in the air mass flow. As the new first two stages would have the same outside diameter as the original stages and merely a reduced root diameter, the outside casings would not need to be altered. The scheme is illustrated diagrammatically. The 26 per cent increased air mass flow was achieved and the efficiency at the design point was also increased by 1½ per cent to over 85 per cent. The new compressor formed the basis of the Mamba 2 engine with a compression ratio of approximately 6: 1 now undergoing development testing.

Only minor improvements can now be expected, but if the maximum performance is to be obtained from a gas turbine engine, said the lecturer, it is exactly these minor improvements in the performance of an already good compressor which will make the difference between a reasonably good engine and one with outstanding performance.

TURBINES

CONCERNING turbines, Mr. Lindsey stated that suitable test rigs were very scarce. Despite this, some very good turbines had been made, especially of the single-stage types, but the efficiency of two and more stage turbines still left much to be desired. Improvements had been made on the Mamba turbine from results obtained from engine testing, but this was a slow and not very certain process, and adequate facilities for the performance testing of turbines themselves had been included in the new compressor test station. It was thought that by a course of intensive experimental investigations into turbine characteristics, improvements of the order of five per cent in existing turbine efficiencies could be achieved.



Insertion of two new low-pressure stages and removal of the last two stages, giving an increase of 26 per cent in air mass flow in the latest Mamba compressor.

COMBUSTION CHAMBERS

TURNING to combustion chambers, it was recalled that the Mamba engine was originally fitted with six combustion chambers of the type which might be described as the standard chamber for most British gas turbines, designed and manufactured by Joseph Lucas, Ltd. Development of a combustion chamber working on the principle of burning vaporized as distinct from atomized fuel was also commenced. Originally this scheme was carried out by arranging for a small pilot burner in the nose of the chamber which directed its products of combustion on to the main mixing chamber. This entailed two fuel systems and a great simplification was made possible by the later realization that the products of combustion from the main burner itself could be used for heating the burner by the simple expedient of allowing the gases to escape from the burner in an upstream, rather than in a downstream, direction.

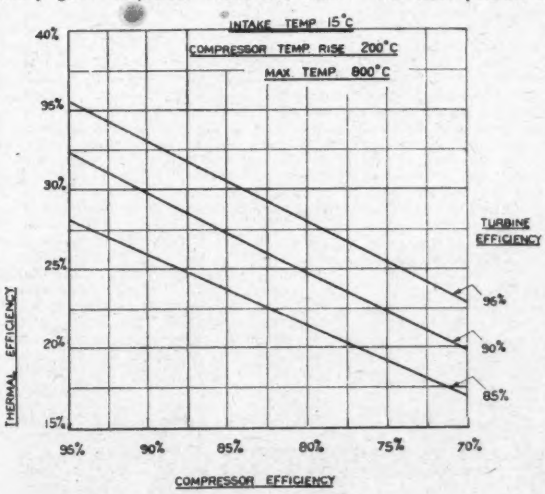
This, then, was the first chamber tried on the A.S.X. engine. After working quite successfully on the test rig the early history on the engine was most disappointing and it was obvious from inspection that combustion was occurring outside the flame tube, with consequent damage to the outer casing. A mixing chamber which had only one entry, instead of two, was designed and this completely cured the trouble, but it was only done at the expense of a slight lack of symmetry on the part of the mixture issuing from the mixing chamber, which is still a feature of this combustion chamber.

Apart from behaving under conditions of high temperature and pressure at sea-level, it is also essential that a combustion chamber operates equally well under conditions of higher altitudes, where the density and temperature is rather low and the fuel consumption is small, said Mr. Lindsey. Conditions are particularly bad when the engine is slow-running, as the pressure and temperature rise in the compressor is then very small and the fuel required is a minimum. The first experience of the behaviour of this vaporizing type of chamber under altitude conditions was obtained in the initial flight trial of the A.S.X. engine. The results of these trials were most encouraging as it was found to be possible to perform all the operations of slow running and restarting at altitudes up to 35,000ft, which was the ceiling of the Lancaster with this installation.

The combustion problem for the Mamba was more difficult as, unlike the A.S.X. engine, the length available for combustion and mixing was restricted. Means had to be found for the processes of pre-heating, vaporization, combustion and mixing in a short length, which meant that some of the processes would have to go on simultaneously rather than one after another as in the case of the A.S.X. chamber. Superficially the Mamba chamber was completely different from that of the A.S.X., but, in fact, the principles involved were identical.

The chamber has behaved very well and it was a chamber of this type which was incorporated in the type test engine.

The cast manifold into which the chambers feed was something of an innovation at the time of its introduction.



Effect of small increases in turbine and compressor efficiency on thermal efficiency.

CONTROLS

MR. LINDSEY next dealt with controls, saying that the development of the turboprop from the pure jet engine introduced a new independent variable into the control system. In the simple jet engine with fixed propelling nozzle the rotational speed of the engine is determined by the amount of fuel supplied and this alone has to be controlled. When power is delivered to a variable-pitch airscrew the rotational speed of the engine can be varied for a constant fuel flow by altering the pitch of the airscrew and hence the power it is capable of absorbing at a given rotational speed.

For the Mamba it was decided to use a similar type of fuel control to that used on a turbojet and to retain the normal piston engine type of constant speed unit for controlling the engine speed. This system seemed to be at least as good as any other and to have the great advantage that its components were already developed to a large degree. Hence, the development work could be confined to satisfactory inter-connection, so that finally the pilot could control the engine by the movement of a single lever.

The relationship between the shaft horse-power and r.p.m. for different fuel flows for the Mamba engine was shown graphically. It could be seen that, generally speaking, the shaft horse-power produced was independent of the r.p.m. over a short range but that there were strict limitations to that statement, as overheating of the turbine and surging of the compressor had both to be avoided. The graph (overleaf) showed the limitation and also contained curves of power absorbed by the airscrew for different airscrew pitch settings. It could be seen that as the speed of the engine dropped from 15,000 r.p.m. to 8,000 r.p.m. the airscrew pitch which could be used with safety, decreased from 23 deg to 12 deg. It was this need to have the airscrew at 12 deg pitch when idling which introduced the main new factor in the airscrew controls of gas turbine engines.

Another feature of the engine performance which was of importance in this connection was the fact that the specific fuel consumption of the engine remained the same at the same shaft horse-power output, even

Development of the Mamba . . . . .

when the speed of the engine was altered over a small range.

After describing the control systems of the Mamba in some detail, Mr. Lindsey went on to discuss their operation in flight, pointing out that special precautions had to be taken because of the ability of the airscrew to fine off right down to 12 deg pitch. This could cause serious trouble in flight in the event of an engine failure.

Pitch characteristics for the Mamba were shown graphically. With a conventional piston engine, which has fine-pitch stops on the airscrew, set at some 25 deg, if the engine fails it will windmill on its fine-pitch stop until such time as the pilot can operate the feathering device. During this windmilling time the position of the fine-pitch stop is such that no abnormal drag is experienced by the aircraft. With the very much finer stop setting required by the Mamba, however, the drag of the airscrew windmilling on the stop can be very serious indeed and might cause a complete loss of flying control on the part of the pilot. The solution to this difficulty is the provision of a "reverse torque switch."

This device, which operated whenever power was fed into the engine from the airscrew, overrode the c.s.u. and, instead of being fined off, the airscrew was coarsened up to its feathering position with a minimum of drag on the aircraft. If the c.s.u. failed in flight, airscrew pitch was uncontrolled and the blades tended to move towards the fine position. They would reduce pitch to 12 deg and would no longer absorb engine power. The engine speed would, therefore, increase until restricted by the overspeed governor.

The 12 deg pitch setting would just allow no drag at 110 m.p.h., which at least made the aircraft safe at low speeds so that an approach and landing could be made. At higher speeds severe drag was caused and above 270 m.p.h. the windmilling torque on the engine was great enough to overspeed the engine to a dangerous extent, despite the fact that the overspeed governor had now cut off the fuel. The graph shows that little or no relief could be obtained by the pilot cutting his engine, as the drag figures for "engine off" were still serious.

REMOVABLE FINE-PITCH STOP

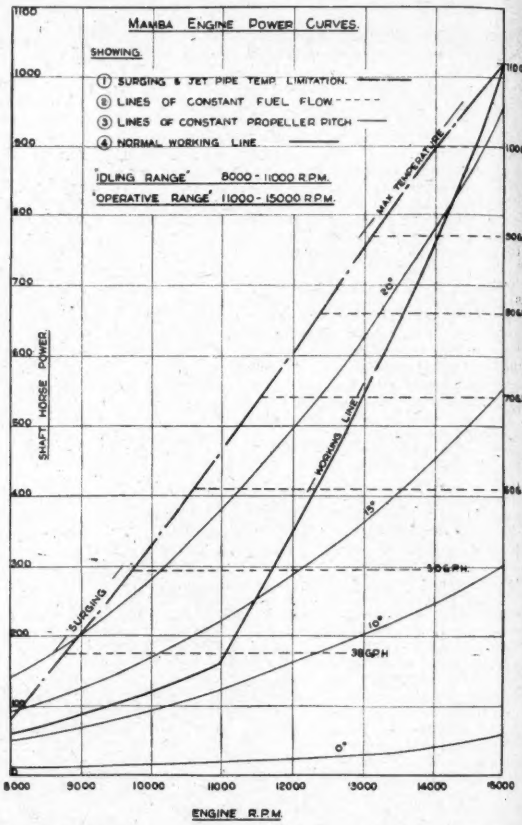
Some extra device therefore must be built into the airscrew control mechanism to act as a safety device under these conditions, and this device must not interfere with the normal operation of the airscrew which was already satisfactory. Such a device had not yet been provided, but at least a partial solution had been found. This was a removable fine-pitch stop which automatically came in whenever the airscrew was coarse enough, but which could be removed either by the pilot or by interlocking it with some other control. The function of this stop could best be explained by an example.

Referring again to the graph, it would be seen that a stop set at 28 deg would prevent engine overspeeding and reduce satisfactorily the drag after a c.s.u. failure. In normal flight the stop would be in whenever the airscrew setting as determined by the c.s.u. was coarser than 28 deg. This, in fact, would occur under all cruising conditions above 200 m.p.h. A c.s.u. failure then in normal flight would result in the airscrew operating in fixed pitch at 28 deg, which would give enough thrust to get the aircraft back to base. It could be seen also that if the stop was left in the engine would be overloaded at any speed less than 180 m.p.h. and would overheat and stall dangerously. The pilot must remember to remove the stop every time he reduced speed below this value in normal flight if he was to avoid trouble. Hence, from a normal operational point of view, this control system was less satisfactory than before.

If the removable stop could be reduced in pitch to 23 deg he would get less protection in case of a c.s.u. failure, but he would not have to remove the stop until speed had been reduced to 140 m.p.h., at which point he would normally select flaps down. Thus the stop removal could be connected to the flap operation and would be carried out automatically. This, at the best, was a compromise, but one which would probably be used for the time being. In the meantime, other methods were being actively pursued.

STARTING

ALL gas turbines, whether turbojets or turboprops, have a minimum speed below which they cannot run under their own power and it is essential in order to achieve a start, to accelerate them by some external means up to this speed. Doubling the power of a starter motor will halve the starting time, and the start will be achieved with approximately the same energy input. It is not necessary in the turboprop to achieve the very rapid starts which are required for turbojets to be used in fighter aircraft, and it has been found that a reasonable period for the starting process is about 20 seconds. The original type of starter used was a displacement motor driven by cartridge gases or compressed air, but it is expected that electric starting will be used in the production phase of the engine.



Relationship between shaft horse-power and r.p.m. using fuel consumption as a parameter. Note the crank in the working curve at 11,000 r.p.m. and 12 deg pitch.

Finally, Mr. Lindsey dealt with some installation problems and specific installations for the Mamba. He said that in general it could be stated that the problems involved in installing the turboprop in an airframe were similar to, but somewhat simpler than, the corresponding problem of installing piston engines. Because of the smooth running of the engine it seems that it will be possible to dispense with flexible mounting.

In the smaller power class, because of the very much reduced physical size of the engine, compared with the piston engine, the accessories become a very real problem. For a civil installation, the housing of such things as cabin blowers and large generators in such a small space is extremely difficult.

The installed power unit was divided into zones. The compressor and auxiliaries (zone 1) containing complete fuel and oil systems, was separated from the hot turbine (zone 2). This was kept at not more than 100 deg C by a ventilation system, and fuel pipes passing through the zone had their own separate cooled ducts. Zone 3 was the jet pipe compartment.

The Mamba engine is a "straight-through" engine in which the air intake diameter is very small and air must be taken round the airscrew spinner and past the airscrew blade roots themselves. With a conventional spinner there is little doubt that considerable loss will be caused by the presence of the somewhat crude blade roots. Flight tests show that this loss is as high as 15-20 per cent of the free stream dynamic head. One way out of this difficulty is the design of a ducted spinner. Aerodynamically there is little difficulty in designing such a spinner, but the mechanical problems involved are difficult.

To save space and weight the cowling behind the spinner and around the intake annulus forms the oil tank which is of spot welded construction to avoid the risk of a loose rivet passing into the compressor. The weight of the complete power plant without airscrew (400 lb) is 1,000 lb.

ANTI-ICING

A PROBLEM which is exercising the minds of aircraft constructors and operators is that of de-icing. It has been thought for some time now that the de-icing of gas turbines, especially the axial flow type, would prove a difficult problem because a large particle of ice breaking off and going through the engine would cause considerable damage to compressor blades. Fortunately, the gas turbine engine is one in which there are large quantities of heat available for de-icing purposes, and if attention is directed towards anti-icing rather than de-icing, there seems to be little doubt that turboprops can be made suitable for flying under severe icing conditions with perfect safety and with little loss in power.

The disposal of the exhaust gases from a gas turbine engine becomes a problem to aircraft designers generally, as the diameter of the jet pipes is usually embarrassingly large. In this respect the turboprop is better than the jet engine, however, for although the exhaust area required is somewhat larger, the energy of the gases is less and it is possible to take more liberties with the disposal of the gases than is possible with the pure jet engine.

DISCUSSION

A VERY interesting discussion was opened by Mr. Edwards (Vickers), who congratulated Mr. Lindsey on the honest, uncoloured account of Mamba development. He questioned the reasons given for the

selection of the axial-flow design, saying that efficiency and size were not all, and reliability must be considered. In the past engines for civil applications had enjoyed military development or background. This was not so with the axial turboprop. The first step for taking passengers into the air with turboprop power units might well be with units using centrifugal compressors, which were rugged, well-tried, and did not suffer in the same way from icing troubles. The stage had been reached when the turboprop could be accepted as a tried and reliable unit, and the addition of an airscrew to the pure jet had given no special troubles and had offered some improvements, particularly increased propulsive effort, which was better for medium-speed aircraft.

Mr. Edwards believed that airscrew and power control problems had been solved, and he believed that what Mr. Lindsey had rightly called devices in this connection should be got rid of. He would like to see a two-stage centrifugal compressor engine with free turbine for the airscrew. Mr. Edwards thought that small diameter for cowlings could be overdone, and added that a few inches on diameter had little effect on drag on 300 m.p.h. aircraft. He thought that the Mamba was one of the most potent means of holding the country's lead in the civil field. Engine manufacturers had done aircraft designers proud. We had a big lead on the world, but we should have to make good use of it or it would disappear.

Air Commodore Banks believed that helical gears for the high-speed train and spur-type for low speed was the correct solution for turboprop reduction gears. Armstrong Siddeley's had done well to prove that an axial-flow engine need not weigh more than a comparable centrifugal type. He supported vaporizing combustion as a good thing, and thought that it should eventually lead logically to annular combustion chambers, but the annular type chamber must last for the maintenance life of the engine if it was to be any good. He rather agreed with Mr. Edwards' doubts concerning the use of axial-flow compressors for small civil turboprops. The need for small turboprops for civil aircraft had been foreseen, and A. Cdre. Banks thought that the four-engine layout was best for civil aircraft. He favoured development of free turbines. He believed that the Americans had doubts about static thrusts from such units and quoted from memory for comparison, the figure of 2½ lb static thrust per h.p. which was obtained from piston engines.

Mr. Woodhams (A. V. Roe), the third speaker, said that all those who flew at Manchester, after being sceptical, were now sold on the turboprop. He asked why a standard c.s.u. had been used on the Mamba, and asked if jet pipe temperature might not be used to control the pitch, the engine speed control being as at present. He thought that 8 h.p. for the starting motor seemed high, and asked if this made provision for starts at −20 deg C.

Mr. Shire (Rolls-Royce) put several questions on reduction gear design. He remarked that the full advantage of the small diameter axial-flow engine could be felt only when the engine was buried in the wing. He mentioned that steel blades were finding favour for axial compressors in America; did Mr. Lindsey agree that steel blades might be a good thing in spite of the weight increase? He also asked for the lecturer's opinion on hollow air-cooled turbine blades.

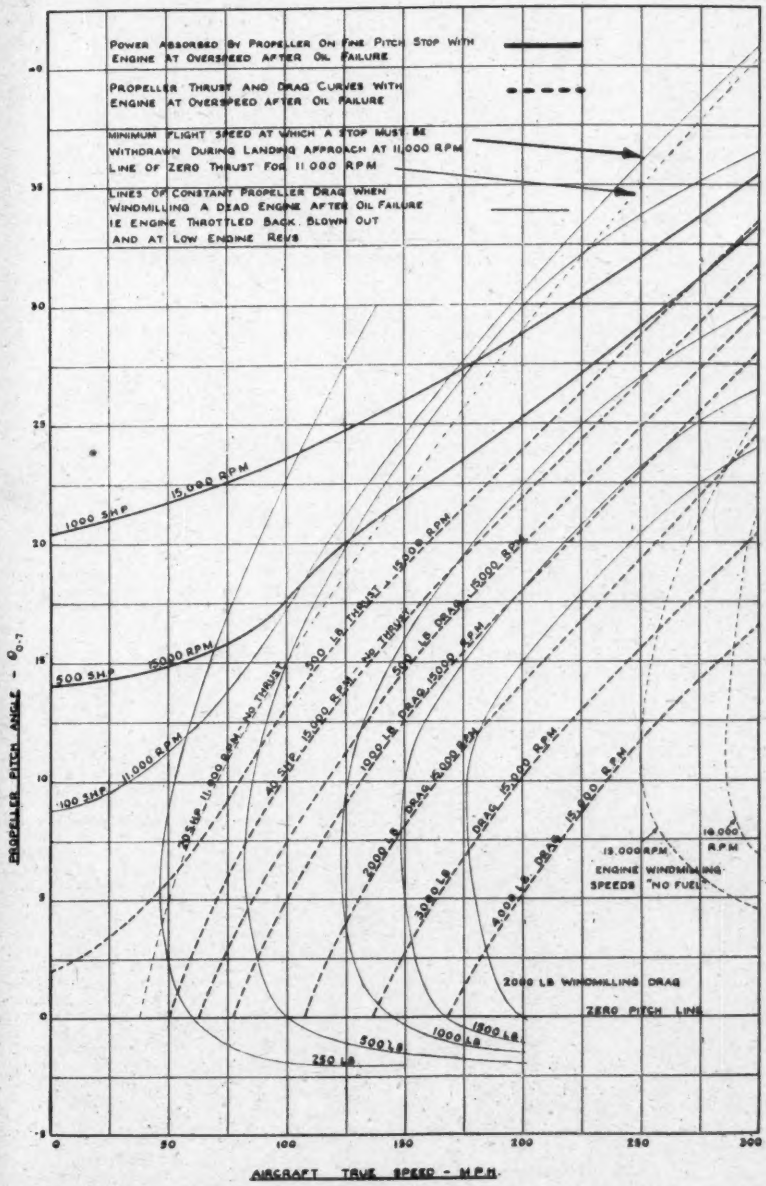
Mr. Moult (de Havilland) mentioned the high compression ratio of 6: 1 with flatter characteristics of the latest Mamba compressor, and asked if the great improvement had entailed other changes in addition to those mentioned by Mr. Lindsey in his paper. He also commented on distribution troubles in connection with low fuel feed pressure at high altitudes. He remarked that small engines had just as many parts as large ones, and asked Mr. Lindsey's opinion on how relative production costs would work out.

Mr. Rowe (B.E.A.) said that a development problem was set for turboprops by the lack of numbers of aircraft in which to test and prove them. In the absence of widespread experience it would be necessary to think how to get more information on the ground. He did not regard the Mamba as being completely developed until icing problems had been solved. He remarked on the risk of icing of the ventilation systems for the hot zone of the engine.

MR. LINDSEY gave most of his replies at once. He agreed with Mr. Edwards on control devices. The system worked but was definitely open to improvement. He did not think that the coupled turbine engine was at a complete disadvantage when compared with the free turbine engine, and he did not agree with the suggestion for a two-stage centrifugal turboprop with separate power turbine. He did not think that the risk of overheating troubles was great with tight cowlings. He thought that Mr. Edwards was a convert to turboprops. He did not share Mr. Woodhams' opinion concerning the use of the standard c.s.u., and he thought that control via jet pipe temperature would have caused its own troubles.

To Mr. Shire he replied that there was no uneven bedding of teeth with the Mamba reduction gear, and that steel blades for axial-flow compressors might come one day, but he was not convinced of it particularly due to the expense involved.

Concerning compressor efficiency, he said that the 1½ per cent increase was due entirely to the greater throughput. He added that the 1,000 h.p. field was the worst to enter with gas turbines, but that the cost was the only real snag by comparison with the piston type. If one depended upon the civil market there would be no gas turbine development. The Mamba 2 compressor was designed for the high ratio obtained. Finally, Mr. Lindsey said that he was convinced that the Mamba could be successfully anti-iced, and that he was not worried about this problem which would be solved in the near future.



What happens when the engine is windmilling at various aircraft speeds. A 12-deg fine pitch setting just allows no drag at 110 m.p.h. which would permit a landing to be made.

DEVELOPMENT OF A NEW AIRCRAFT

Tackling the Problems of Cost and Complication

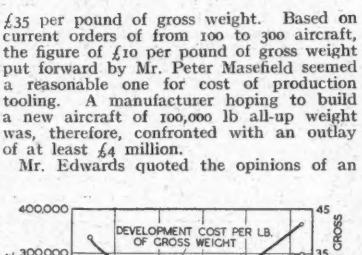
INTRODUCING his lecture *Problems in the Development of a New Aeroplane*, read before the Royal Aeronautical Society on Thursday, December 2nd, Mr. G. R. Edwards* said that he had attempted an assessment of some of the more fundamental problems confronting aviation, chief amongst which was the high development cost of a new aircraft. The twofold object of his lecture was to probe into the causes of the present situation, assessing some of the problems involved, and to offer some constructive suggestions as a contribution towards a reduction of these heavy commitments.

To a crowded lecture hall Mr. Edwards, whose keen sense of humour was much appreciated, made many valuable suggestions. The reading of sections of his paper was followed by an excellent discussion, opened by Mr. N. E. Rowe and continued by Mr. R. E. Bishop, Mr. W. E. W. Petter, Mr. S. Scott-Hall, Prof. R. L. Lickley, Mr. A. E. Woodward-Nutt, and Mr. S. D. Davies. All these speakers found many points in the lecture with which they firmly agreed, but each disagreed equally strongly with others. In particular, Mr. Edwards' opinions on the basing of civil types on similar or common military prototypes came under fire. Mr. Edwards prefaced his lecture by saying that the generation of aircraft preceding that with which the Armed Forces and civil operators were equipped at the outbreak of the late war was much less complex. In those days the time between basic design and acceptance would be measured in months. Nowadays the units of time had become years, and the money expended before a single production aircraft left the assembly line could be measured in terms of millions of pounds. This phenomenal increase, while purely the natural result of more complexity of design and equipment, derived largely from the development methods and procedure at present employed.

Costs of £2 10s to £3 per pound of gross weight were representative of modern civil aircraft and were reasonably constant for all sizes. The cost of production for larger types would probably show a reduction. Development costs also increased approximately directly with all-up weight, and appeared to amount to £30 to £35 per pound of gross weight. Based on current orders of from 100 to 300 aircraft, the figure of £10 per pound of gross weight put forward by Mr. Peter Masefield seemed a reasonable one for cost of production tooling. A manufacturer hoping to build a new aircraft of 100,000 lb all-up weight was, therefore, confronted with an outlay of at least £4 million.

Mr. Edwards quoted the opinions of an American expert, Mr. I. M. Laddon,† on the production of a new transport aircraft. He had stated "The opportunities for profit . . . are so limited that the business judgment of any company undertaking such a project . . . may be seriously questioned." He estimated that sales of 400 Convair-liners would be required before the constructor reached the break-even point and recovered his outlay. Mr. Edwards continued: "The foregoing serves to indicate that the risk entailed in developing a new aircraft can no longer be borne solely by the manufacturer."

Need for reducing development costs remained. Aviation must be self-supporting and the State financing of this development in no way relieved all concerned from doing everything in their power to carry out economies consistent with the production of efficient aircraft.



Development cost for civil aircraft increases approximately directly with all-up weight, and amounts to £30 to £35 per lb. of gross weight.

COMPLEX EQUIPMENT

THE chief business of civil aviation the world over was to pay its way. It must ensure, therefore, that it did not make its aircraft less efficient than they could be. Improvement in overall economic efficiency was the yardstick. In general, aerodynamic and structural efficiency, plus low fuel consumption, were worth a lot of trouble to achieve.

The question which operators and designers must ask themselves when considering an additional piece of equipment was this: Was the eventual cost in lost serviceability, caused by extra maintenance, worth the advantage gained in operational efficiency or, in the case of a civil transport, in increased business? A specific example within the author's own experience was the cabin-heating system on the Vickers Viking. With a view to giving maximum passenger comfort, this was first fitted with a thermostatic control. Unfortunately, considerable trouble was experienced with the control gear, and it was decided eventually to substitute manual control regulated by the steward. The availability of the aircraft to carry fare-paying passengers was thereby increased, and one could scarcely believe that such a saving would be likely to be offset by a decline in bookings.

Many complications have been brought in with the object of relieving the pilot, but automatic operation usually brings in its train a mass of indicators and warning lamps until cockpits nowadays tend to vie with Piccadilly Circus in the way of bright lights. In peacetime, particularly on scheduled airlines, one is entitled to expect pilots to be skilled enough to retain much of the control in their own hands.

Mr. Edwards next commented on contract procedure and cancelled and redundant tenders. He said that rejection of a type after the prototypes were finished was very serious for a company. The firm whose prototype was discarded after having its design and experimental capacity tied up for two or three years would be in the unfortunate position of having no production order to follow. The task of forecasting conditions five or six years ahead for a military aircraft was a formidable one, but the writer of a requirement for a civil aircraft was not embarrassed by the same unknowns.

There were a number of ways in which an individual constructor could guard against being caught out with a rejected tender. First, it was essential to build up a flexible design and experimental organization; secondly, he must design an airframe readily adaptable to the accommodation of new equipment and engines, and it was a good thing to complete the prototype early, as a wavering customer was often helped to make up his mind by a piece of ironmongery.

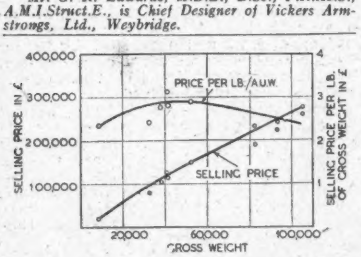
Anyone requiring confirmation of the state of affairs outlined above was referred to the Courtney Report on the Tudor. It laid considerable stress on the delay brought about by the operator's insistence on the inclusion of inessential features not affecting the safety of the aircraft. Agreement at mock-up and other conferences was apparently no insurance against the operators' changing their minds at a later date. Of the increase in all-up weight from 75,000 to 80,000 lb, no less than 1,600 lb, or nearly one-third, was caused by modifications demanded for cabin furnishings alone. One was left with the feeling that the operator's technical staff were completely out of touch with the down-to-earth problems confronting the designer in the complicated business of building a modern aircraft.

It was the author's opinion that the travelling public was by no means as fastidious over details as operators would have us believe.

Mr. N. E. Rowe‡ was quoted as saying: "Cheap air transport can only be obtained by a marked reduction in all-up weight of aircraft per passenger. . . . The most effective factor in design to this end is the reduction in structure weight, and, of course, in the weight of equipment and amenities which are specified by the operator as *essential* for safety and comfort." (The italics are the present author's.)

Looming ahead, there was yet another debilitating factor in the complicated equation of aeronautical economics. That was the ten-year replacement plan now being talked of by civil operators. With little competition from rival airlines running more modern types, the national corporations were under no pressure to replace out-of-date transports earlier. Itself an outcome of high costs, this policy completed a vicious circle which would eventually raise costs still further.

In any case, the result from the manufacturer's point of view was unattractive. Having produced the handful of aircraft ordered, he must wait ten years before being able to submit another tender, and then with



The selling price of aircraft is seen to vary almost directly as the all-up weight, and to amount to £2 10s to £3 per lb. of gross weight.

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† *Late Executive Vice-President of the Consolidated Vultee Aircraft Corporation.*

‡ *Mr. N. E. Rowe, C.B.E., D.I.C., B.Sc., A.C.G.I., F.R.Ae.S., Whit. Ex., Controller of Research and Long-Term Development, B.E.A.*

Development of a New Aircraft . . . .

only a fifty per cent chance of success. Consequently, unless he could sell his products abroad, he must find other work to do, or he would lose valuable technical staff and fail to keep in touch with advances in modern technique.

Comments on the effect of delayed development and on the traditional policies of firms followed.

DEVELOPMENT COSTS

IF the firm's production capacity was already occupied with a large order that would keep the shops busy for some time to come, a Chief Designer would be free to proceed with long-range planning and embark on new projects. It frequently happened, however, that the immediate need was for what might be termed a "bread-and-butter" type; one that, requiring a small amount of project work, would fill the shops at short notice. One of the most attractive types of "bread-and-butter" aircraft from the manufacturer's point of view was a major conversion of an established type.

In a country so short of technical resources as ours, every effort should be made to meet a new demand by means of a variation of an existing type, before launching forth on an expensive and unknown new design.

A major cause of the troubles experienced from official routine was the disparity between military and civil requirements. The cure was that civil aircraft should be derived from basic military types, the original specification being laid down by the Director of Requirements, Air Ministry, advised by civil operators.

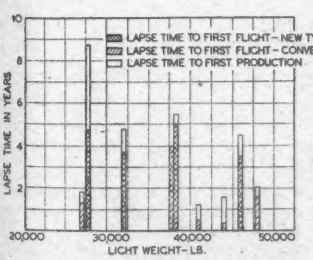
The facilities for exhaustive trials in the service far exceeded those available to civil operators. That essential process familiarly known as "getting the bugs out" of a new design would be completed, as far as the civil version was concerned, at the antenatal stage.

One of the chief difficulties confronting the civil operation of turboprops was the absence of previous military operation.

It was the author's opinion that the alternating of new and conversion types in the production programme also provided one of the most satisfactory contributions the manufacturer himself could make towards a solution of current problems.

It was not intended to imply that each new type should be limited to a single major conversion. A really sound basic type might be capable of producing several versions, both military and civil. First-class aircraft came seldom enough to warrant their being discarded after they had satisfied their original purpose.

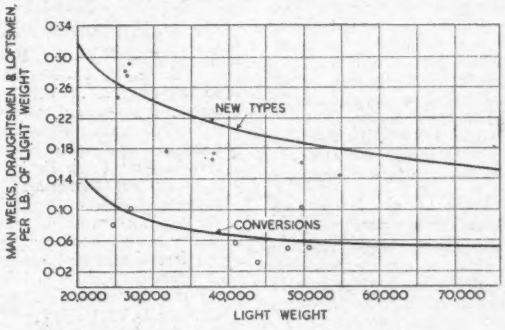
Talking of new types, Mr. Edwards said that he believed it would be advantageous if, while drawing up the specification, selected firms in the industry were consulted at an early stage in order to get their views on the feasibility of the project.



Time comparisons between new types and major conversions. An important saving in lapsed time between formulation of the requirements and the start of production is apparent.

ENGINE DEVELOPMENT

THE present state of gas turbine development made it difficult to assess future events. Present experience was largely confined to centrifugal types, and medium performance civil and military aircraft might well continue to be powered by them. The higher compression ratio and smaller frontal area associated with the axial compressor would make it the future engine for high-performance types, particularly where buried installations were feasible. The author would make a plea for a long-term limitation in size change so that the engine bays in buried installations could be designed to accommodate all types of engines which might be fitted during the life of the aircraft. The declared power should be based on an engine *certain* to be ready for the prototype, rather than on a higher-powered projected engine which might not, after all, materialize in time.



Comparison in drawing office times to first flight for new types and major conversions.

Mr. Edwards next said that he proposed to follow the aeroplane through its successive development stages, and in so doing to consider its relation to the various departments concerned.

By far the biggest contribution a manufacturer could make towards cutting costs was sometimes overlooked. That was, getting the aircraft right the first time.

When examining the original requirements a designer had first to decide when special emphasis should be placed on any particular feature or aspect of the aircraft. It was inadvisable to embody too many untried features in a single new design.

PROJECT OFFICE

THE first stage in preparing a tender, which would occupy some six months, took place in the project office and was concerned chiefly with the basic characteristics of the aircraft. This was the stage at which a Chief Designer must be prepared to make firm decisions. The example of German project methods as exemplified by the Messerschmidt organization was a case in point. There, up to 1,000 combinations based on 20 variations of a project were considered. It was here that sound judgment was required; two or three alternatives at most might be considered at this early stage and the sooner they were reduced to one, the better.

Mr. Edwards then discussed design considerations with relation to a specific aircraft required to carry 32 passengers at a cruising speed of 240 knots over a still-air range of 900 nautical miles. The production process was then carried to the stage of submitting the tender, with data and necessary project drawings, together with a time programme and a target date for prototype and first production aircraft. Planning and estimates, the third project stage, and aerodynamics were considered next.

If there was one branch of aircraft design likely to give rise to a greater number of problems than another, during development, it was aerodynamics. Few aircraft during recent years had not been threatened with delay because of this.

The fundamental reasons for this state of affairs might be listed broadly under four headings, in ascending order of seriousness.

1. The increasing severity of requirements.
2. The difficulty of making basic structural alterations after the aircraft has flown.
3. The inaccuracy and insufficiency of results from obsolete equipment unable to cope with modern speeds and aircraft sizes.
4. The complications introduced by so many additional design parameters—compressibility, sweepback, shock waves, extreme altitudes—and the lack of sufficient relevant design data to guarantee success.

It was unlikely that such a drastic introduction of higher standards in so short a time would occur again.

Time spent by senior designers in attending committees concerned with the formulation of national requirements was by no means so wasteful as it might seem, when considered in conjunction with the actual design time thereby saved.

AERODYNAMIC TEST EQUIPMENT

ALTHOUGH derided by some, there could be little doubt that on the wind tunnel fell the brunt of aerodynamic design, whether the data so obtained took the form of *ad hoc* information on specific models or of empirical formulæ of a general nature. With one or two notable exceptions, wind tunnels now in use were built some twelve or more years ago when the average speed was of the order of 200 m.p.h. and an aircraft weight of 25,000 lb was considered excessive. Since then, speeds of 600 m.p.h. and weights of 100,000 lb were not unusual. The need for accuracy in wind tunnel data had increased tenfold, a demand which none but the newest tunnels could meet. The need for new wind tunnels of sufficient size and speed was imperative if we were even to keep pace with requirements.

Some idea of the cost might be obtained from the Co-operative Wind Tunnel at Pasadena, which was used by four major aircraft firms. The tunnel was operated for 11 to 14 hours a day, and apparently costs each firm about £50,000 a year.

The addition of new fundamental variables was necessitating exhaustive tests on almost all new designs. Because of the very limited high-speed testing facilities available in this country, and because existing wind tunnels could not operate for more than 24 hours a day, the supply of basic empirical data on which the industry relied was unlikely to mature.

This bleak outlook was extremely serious, and the aircraft industry could not afford to allow the situation to continue. The Government must encourage the industry to build for itself subsonic and supersonic wind tunnels in order to relieve the load from the research establishments at the earliest possible moment. Without these, we should be forced to fall back on the time-honoured custom of analysing American data on aircraft bearing some resemblance to the one in hand. This inevitably led to inferior design and to aircraft which could not compete with American types derived from the original data.

A similar plea for the energetic construction of research aircraft was made. The amount of information now available on the effect of sweepback in delaying the onset of compressibility was small and mainly confined to model tests. Invaluable full-scale flying tests could be made on aircraft derived from basic square-wing fighters in which the addition of sweepback was the only design change.

(*The conclusion and discussion will be published next week.*)

CORRESPONDENCE

The Editor does not hold himself responsible for the views expressed by correspondents. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

SINGLE-ENGINE PERFORMANCE

Experience with a Bristol Beaufort

THE letter from Mr. Eric A. Starling in your issue of November 11th is most interesting, and I am inclined to agree with him that it would be better to keep an airscrew windmilling if such a thing as a free-wheeling device could be fitted in the airscrew boss. Or even if such were not fitted.

In the early days of the recent war, when fully feathering airscrews were *not* fitted to Taurus-engined Beauforts, "flak" relieved one engine of its oil. During the few minutes before the engine seized up I had hopes of getting home on "one." When, however, the machinery had locked itself solid, the drag of the stationary airscrew (in coarse pitch) was so great that control became difficult indeed and in a very short time I was obliged to put the aircraft down on the water.

Folkestone, Kent. A. P. CULVERWELL, A.F.C., S/L., R.A.F. (Ret.).

B.E.A. DISPUTE

Plea for a Comprehensive Investigation

FOR the past two years I have continuously read and digested most of your articles with reference to the financial morass in which our State-owned airlines find themselves, and their so-called economic purges to reduce the burden on the taxpayer. Now, finally, the action of the B.E.A. engineers at Northolt prompts me to express my humble opinion, an opinion of an engineer employee of the aforementioned Corporation.

Before we can hope to attain financial independence in the time forecast by Mr. Masefield, it is my conviction that an independent committee will have to carry out a comprehensive investigation into all the branches of the Corporation down to the last outstation. Should any individual employee, who wishes, be given the opportunity to place his constructive ideas before this committee and is able to reveal instances of gross inefficiency without the penalty of victimization, the subsequent combing-out of the culprits would result in a Corporation in which it would be deemed a high honour to serve.

Far be it from me to condone the action of the strikers, whose four-point demand at first seems ludicrous; it is evident, however, on further investigation, that their grievances are justified. A. N. OTHER.

Scotland.

SERVICE OR CIVIL?

R.A.F. Methods Scorned by Airlines

SINCE leaving the Royal Air Force, over two and a half years ago, I have been struck by the almost childish antagonism of many in civil aviation towards the R.A.F. and its methods. I noticed this from the moment I joined one of the nationalized airline Corporations as a pilot in 1946.

R.A.F. methods of flying training and operational flying have been criticized and scorned. This has generally been done by the pre-1939 civil type of pilot, although in many cases they themselves learnt to fly in the Service. Now this attitude is even being adopted by many of the wartime pilots. Without wishing to cast a slur upon my own profession, I think that Service pilots are just as sound in all aspects as civil pilots.

The practical aspects of flying appear to be secondary in the eyes of the M.C.A. This outlook has thus become the outlook of many civil aircrews. New and highly theoretical methods of navigation are readily accepted, but new and improved methods of practical flying seem to be disregarded. The civil authorities appear slow to use the vast knowledge which was gained at high cost during the war by the R.A.F.

Recently, when the R.A.F. Transport Command flew a Handley Page Hastings to New Zealand, a member of B.A.L.P.A. wrote an article in the B.A.L.P.A. "Log." This article maintained that this aircraft should have been given to a civil airline to test it over various routes. It also maintained that civil crews were better suited to get the "bugs" out of new aircraft of this type.

Surely this is rather a futile argument. Civil airlines are expensive enough without being asked to test new equipment. The R.A.F. has more facilities for this work and can do it at less expense.

A similar case is the Gust Research Unit, equipped with Mosquitoes, of B.E.A.C. What is the purpose of Boscombe Down and Farnborough? Surely this job could be done by R.A.F. crews, or is this peculiar jealousy of the R.A.F. by civil airlines too great? B. D. H.

Staines, Middlesex.

EARLY FOKKER AIRCRAFT

Mr. Nash's D.VII Probably Not a Richthofen Machine

IT is doubtful if the Fok. D.VII specimen referred to by Mr. R. G. J. Nash (November 18th) has actually belonged to the original Richthofen Circus (which was not a squadron but an independent group formed of several fighter squadrons). All serviceable aircraft of this formation were actually flown back to Germany or to Switzerland in November, 1918. I am certain that Fritz Beckhardt (1097, Finchley Road, London, N.W.11) could help Mr. Nash to identify his Fok.D.VII; Fritz Beckhardt flew with the Richthofen Circus from its inception. He has not only a number of victories to his credit, but was rather conspicuous to both sides because of the craft he flew.

There would be little difficulty in constructing flying replica of practically all the better known Fokker fighter types, including the triplane (Fok.Dr.I), the Fok.D.VII biplane, and the Fok.D.VIII (E.V.) "Flying Razor" parasol. I possess all the drawings, data, and specifications. Incidentally, the Fokker types shown in American films were usually fakes, and very poor ones at that. It is not the painting which makes an historical aircraft genuine in the eyes of those who have any idea of the original. A. R. WEYL.

Dunstable, Beds.

Where are those from the Museums?

IN his letter referring to the Fokker D. VII aircraft, in *Flight* of November 18th, Mr. R. G. Nash wonders if others of the type happen to exist. It seems most unlikely that there are other specimens, but this does raise the question what happened to the one that was once in the War Museum collection. In the early days of the Museum's history, i.e., when it was housed at the Crystal Palace in the early 'twenties, the aircraft on display formed a very considerable and varied collection of British and German types from the 1914-18 war. Subsequent moves and limitations of space have reduced the number of types on show, and the V-1 period further deleted the old Short Jutland type biplane. The remainder seems to have gone into storage and thence through various stages of neglect and quite unforgivable destruction. Some were once in the basement of the Science Museum, getting more battered and more dusty as the months passed. They then went to Cardington—and may be there yet. The remains of a triplane and an L.V.G. turned up at the Kemble sales in 1946 and, presumably, are pieces from the collection. The D. VII in the exhibition was originally in airworthy condition, but became progressively battered and useless from neglect.

Surely there should be some enquiry into this state of affairs, for these momentos are part of the National heritage and tradition. Also, what, by the way, is being done to form a worthy museum of 1939-45 relics? We presume nothing at all—for public feeling in these matters is negligible. What else can be expected of the masses whose range of vision extends no farther than Friday's pay packet or the week-end pool results. S. O. BRADSHAW.

Stanmore, Middx.

NEW IDEAS

Immediate Consideration Imperative

DR. J. NOEL JACKSON'S request, in your issue of November 11th, for a fair hearing for new progressive ideas, should receive attention without delay if this country is to maintain its place in world affairs.

The examples he gives of his proposals, put forward years before their adoption, are typical of many others, and show how advisers whose experience and qualifications are unknown, have prevented the putting into practice of schemes which undoubtedly would have saved life and unnecessary suffering.

The public should be told the names of those who have now received credit for the proposals and those who were respon-

sible for the delay, because until responsibility rests somewhere, cases of this sort will continue.

With regard to proposals and ideas relating to aircraft and military equipment, a proper and immediate consideration of them is imperative, otherwise we shall be in a state of unpreparedness similar to that before the last war, but without the time in which to catch up.

Men in high places have assured us that all steps would be taken to prevent a recurrence of this unpreparedness—let us have action! J. R. ANDERSON, D.F.C., A.R.Ae.S.

London, N.W.6.

CLIPPED WINGS

A Sharp Reminder of Past Events

AS you have graciously accorded Herr Hans-Joachim Kowsky space to "moan" at certain restrictions imposed upon his kennel-mates, would you allow me space to reply?

I will be brief. Twice in my life H. J. K.'s mongrel brothers have started bloody wars. Now he wants a ball to play with 'ere he changes it for a bone—to be fought for later.

Agreed that prior to 1939 some of us may have thought the Hun was a sportsman when we visited the Rhön. We have since had this error—inexcusable as it was—corrected.

Let Herr Hans-Joachim Kowsky be content, thankful he is still alive, and devote his full efforts, not to aeronautics, but to greater production and so ease the burden of his sportsmen friends(?). L. S. ASH, S/L., R.A.F.V.R.

Wootton Bridge, I.o.W.

Once a German, Always a German

UNDESIROUS of being hoist by my own petard, I'll be brief. We are often told there is a shortage of paper. How, then, do you justify the publication of so grossly an impudent suggestion as Hans-Joachim Kowsky made in his letter published on November 18th? Whether or not he and his friends in Germany should be allowed to fly is not immediately important, but that he should appeal to our sportsmanship (and you should publish his appeal) makes me mad.

"And cannot the English pilots feel with us?" he says. Yes, sir, but not in the psuedo Germanically naïve way you would like us to. "ONE OF THE FEW."

[*We should not have thought that our purpose in publishing Hans-Joachim Kowsky's letter was so subtle as to escape our correspondent.*—ED.]

PETROL FOR RESERVISTS

Cancellation of Half-rate Tax

APPEALS for more members for the reserve forces have made quite a clamour of the Petroleum Board's great-heartedness in refunding petrol used by R.A.F.V.R'ists living out during fifteen days' annual training.

The special issue of petrol for attending Reserve Flying Schools is a major lure in recruiting notices, although this ration is apportioned very severely, according to age, horse-power and miles per month of the car involved (checked most efficiently by adjutants, etc.).

BUT: these bounteous gestures have the usual fly in the proverbial ointment, for in order to revel in all this abundance the lucky reservist must forfeit a hard-won concession. His half-rate tax permitting him to do his daily three miles' joy-riding on a "standard" petrol allocation must be relinquished, and full tax paid so that he may "have the honour to be—sir!" the country's obedient servant, and mop up "juice" in the Tiger at a rate of approximately seven gallons per hour!

I know that many will say car owners should be glad that they have not to walk, ride, hitch-hike *ad infinitum*, but in my admittedly biased opinion this is hardly the way to keep 'em happy and rolling in, and further fumble-fisted fuellery will arouse the old cries of "Let me volunteer—out!"

Leicester. "474."

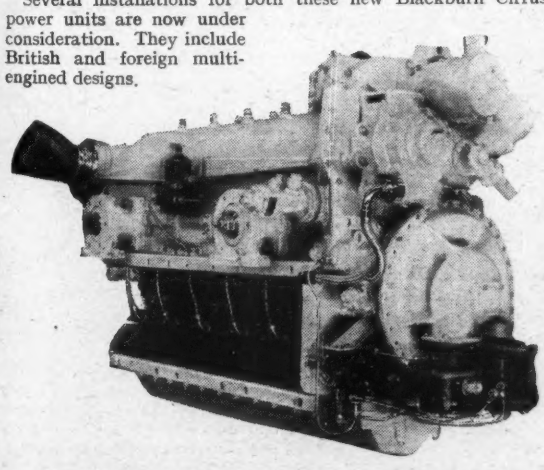
BOMBARDIER AND GRENADIER PROGRESS

THE Cirrus Bombardier 702, one of the few medium-small aircraft engines to have direct fuel injection, flew for the first time last week in a Miles Messenger airframe. The duration of the flight was about 30 minutes. Most advanced of the latest Cirrus series, the Bombardier has completed its type test successfully (although official confirmation is awaited) the following power figures being established on 87 octane fuel:

Sea level take-off power: 180 b.h.p. at 2,600 r.p.m.
Max. cont. power: 158 b.h.p. at 2,300 r.p.m. at 1,250ft.
Max. w.m. power: 128 b.h.p. at 2,200 r.p.m. at 3,250ft.
Max. w.m. consumption: 7 g.p.h.

Development of the moderately supercharged six-cylinder Cirrus Grenadier I is continuing satisfactorily. This unit is also fitted with Hobson direct fuel injection equipment and a Rotol constant-speed airscrew. Take-off output of 307 b.h.p. at 2,500 r.p.m. and +5 lb boost are provisional ratings on 91 octane fuel. The maximum w.m. power is 252 h.p. at 2,300 r.p.m. and 6,700ft, the consumption for this condition being 15 g.p.h.

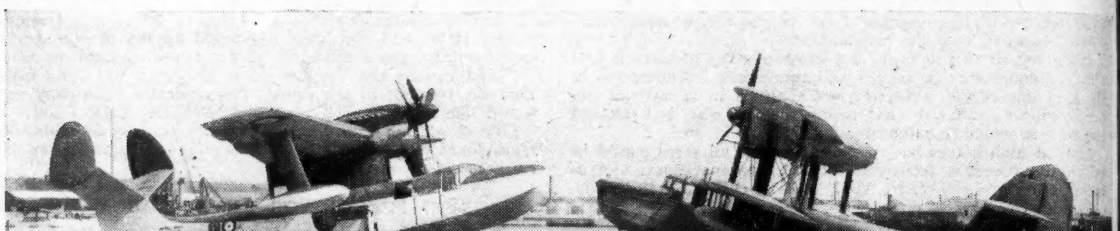
Several installations for both these new Blackburn Cirrus power units are now under consideration. They include British and foreign multi-engined designs.



The 300 h.p. Cirrus Grenadier from the supercharger end.

FORTHCOMING EVENTS

Dec. 9th.—Association of Auto-electrical Technicians: Ninth Annual General Meeting.
Dec. 9th.—R.Ae.S. (Coventry): Lecture by E. Smith.
Dec. 11th.—British Interplanetary Society: "The Problem of Interplanetary Flight (Part 1)"—Two Papers. "The Dynamics of Interplanetary Flight," A. C. Clarke and "Limitation of the Chemical Rocket" A. V. Cleaver.
Dec. 14th.—Royal Aero Club Aviation Centre: Film evening. "Operation Crossroads," "Berlin Air Lift" and "The Royal Presentation of Colours, R.A.F. College, Cranwell."
Dec. 14th.—R.Ae.S. (Belfast): Film Evening.
Dec. 15th.—Aircraft Recognition Society: Recognition and Aviation Forum. C. G. Grey, Prof. A. A. Hall, L. Satterthwaite, H. R. Gilman and P. G. Masefield. Chairman: Charles Gardner.
Dec. 15th.—R.Ae.S. (Weybridge): Annual General Meeting.
Dec. 15th.—Herts and Essex Aero Club: Annual Ball, Park Lane Hotel.
Dec. 16th.—Royal Aeronautical Society: "Present thoughts on the Use of Powered Flying Controls in Aircraft," D. J. Lyons.
Dec. 16th.—R.Ae.S. (Isle of Wight): Annual General Meeting and Film Show.
Dec. 17th to Jan. 20th.—Royal Geographical Society and Institute of Navigation: Joint exhibition, "Navigation through the Ages." Lecture. Dec. 17th.—"Radio and Position," Sir Robert Watson-Watt, C.B., F.R.S. Lecture Dec. 20th.—"The Navigator's Story," Prof. E. G. R. Taylor and Prof. W. M. Smart. Jan. 10th.—Three films on radio systems. Commentary by R. F. Hansford.
Dec. 17th.—R.Ae.S. (Portsmouth): "Some Aspects of Carrier Operation," Capt. (E.) B. H. Cronk, D.S.C., R.N. (Retd.).
Dec. 21st.—R.Ae.S. (Graduates and Students): "Production—The Dynamics of People at Work," J. V. Connolly, B.E., A.F.R.Ae.S.
Dec. 23rd.—R.Ae.S. (Glasgow): Annual General Meeting.
Jan. 11th.—R.Ae.S. (Belfast): "One Thousand Miles an Hour," Prof. G. T. R. Hill, M.C., M.Sc., M.I.Mech.E., F.R.Ae.S.
Jan. 15th.—British Interplanetary Society: "The Problem of Interplanetary Flight" (Part 2).—"The application of Nuclear Energy," L. R. Shepherd. A summary and Discussion of Parts 1 and 2 will follow.
Jan. 19th.—Royal United Services Institution: Films, "Operation Crossroads" and "Operation Plainfare," W. Courtenay, M.M.
Jan. 22nd.—Helicopter Association of Gt. Britain: "Helicopter Operations—Some of the Problems and Prospects," N. E. Rowe, C.B.E., D.I.C., B.Sc.
Jan. 28th.—R.Ae.S. (Weybridge): Annual Dance.
Feb. 1st.—R.Ae.S. (Belfast): "The Propeller Turbine Engine," F. M Owner, M.Sc., F.R.Ae.S., M.S.A.E.
Feb. 2nd.—Royal United Service Institution: "Meteorology in War," Sir Nelson King-Johnson.
Feb. 9th.—Royal United Service Institution: "Land/Air Warfare," Air Vice-Marshal W. L. Dawson, C.B., C.B.E.
Feb. 9th.—R.Ae.S. (Weybridge): "Civil Air Transport," P. G. Masefield, M.A., F.R.Ae.S.
Feb. 12th.—British Interplanetary Society: "The Design of Liquid-Propellant Rocket Motors," J. Humphries, B.Sc., G.I. Mech. E.
Feb. 18th.—Institute of Navigation: "Operational Aspects of Marine Radar." A Symposium of Papers. Chairman: Sir Robert Watson-Watt, C.B., F.R.S.
Feb. 22nd.—R.Ae.S. (Belfast): Lecturettes and Informal Discussion.
Feb. 26th.—Helicopter Association of Gt. Britain: "Helicopter Transmission Systems," K. Watson, A.R.Ae.S.



GENESIS: Illustrating the remarkable advance achieved by Vickers-Supermarine in the design and construction of amphibious flying boats: Right the Sea Otter, a pre-war design (in its turn a notable improvement on the Walrus), and left, the new Seagull.

SERVICE AVIATION

Royal Air Force and Naval Aviation News and Announcements

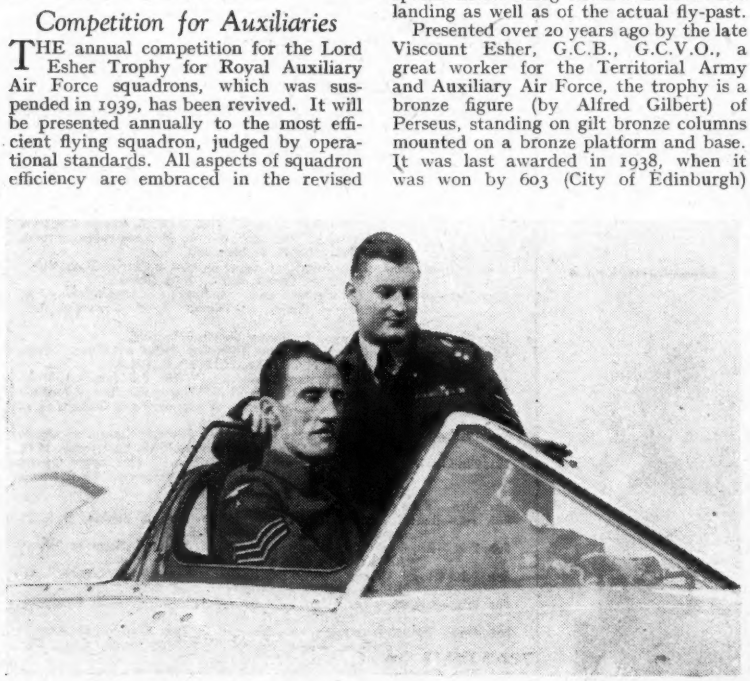
R.A.F. Appointment

THE Air Ministry has anounced that A.V-M. F. J. Murphy, C.B.E., K.H.S., has been appointed Principal Medical Officer of the R.A.F. Mediterranean and Middle East Command. Since July, 1947, A.V-M. Murphy has been P.M.O. of Technical Training Command; he was appointed an Honorary Surgeon to the King in June, 1947.

Competition for Auxiliaries

THE annual competition for the Lord Esher Trophy for Royal Auxiliary Air Force squadrons, which was suspended in 1939, has been revived. It will be presented annually to the most efficient flying squadron, judged by operational standards. All aspects of squadron efficiency are embraced in the revised competition rules, marks being awarded for pilot efficiency, maintenance efficiency (as reflected in flying hours), recruiting, attendance at annual camp, and discipline. The A.O.C.-in-C., Reserve Command, will personally award the marks for discipline at his annual inspection, and will also award some of the marks for pilot efficiency when he sees the fly-past on the same occasion, special notice being taken of take-off and landing as well as of the actual fly-past.

Presented over 20 years ago by the late Viscount Esher, G.C.B., G.C.V.O., a great worker for the Territorial Army and Auxiliary Air Force, the trophy is a bronze figure (by Alfred Gilbert) of Perseus, standing on gilt bronze columns mounted on a bronze platform and base. It was last awarded in 1938, when it was won by 603 (City of Edinburgh) Squadron. In 1926, the first year of the competition, and again in 1928, the trophy was won by No. 601 (County of London) Squadron. No. 605 (County of Warwick) Squadron were the second holders of the trophy, which they won in 1927 and again in 1930, 1931, 1933, 1934 and 1935. It was held by No. 602 (City of Glasgow) Squadron in 1929 and No. 604 (County of Middlesex) Squadron were the winners in 1932, 1936 and 1937.



OLD HANDS: Two members of No. 500 (County of Kent) Auxiliary Squadron—Sgt. Etches (left) and Sgt. Stitt—whose association with the unit dates back to 1938, when they were both serving as L.A/C.s. They remained in 500 Squadron throughout the war, and rejoined when it was re-formed after their "demob."

43 Squadron Revived

FOR many years before the war, Tangmere was the base of two famous R.A.F. fighter Squadrons—No. 1 and No. 43. No. 1 Squadron returned to its traditional home in 1946, and it is now intended to complete Tangmere's link with pre-war days by renumbering No. 266 Squadron as No. 43. An appropriate ceremony will be held at the Station early next year and it is hoped that Marshal of the Royal Air Force Lord Douglas of Kirtleside, first squadron commander of "43" will be present.

Carrier Transfer

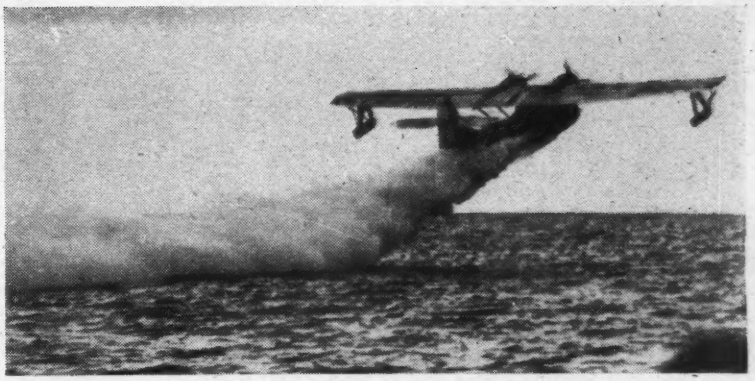
THE Royal Navy's light fleet carrier, *H.M.S. Terrible*, will be handed over to the Royal Australian Navy at Devonport on December 16th, and is to be renamed *H.M.A.S. Sydney*. The first Lord of the Admiralty, Viscount Hall, will perform the handing-over ceremony, and the ship will be received on behalf of the Dominion by the Rt. Hon. J. B. Beasley, High Commissioner for Australia. The first carrier to be built and completed at a Royal Dockyard, the *Terrible*, will also be the first large warship to be completed specifically for the R.A.N. Her transfer will mark the inauguration of Naval Aviation in Australia.

Rescue by Sunderland

WHEN a boat containing five men from the fishing village of Kalutara, on the east coast of Ceylon, 20 miles

Service Aviation . . . . .

south of Colombo, became overdue, anxiety was increased because of a gale and heavy seas on the previous day. The local police asked the help of the nearby R.A.F. station at Katukurunda. The officer commanding immediately got in touch with the R.A.F. flying-boat base at Koggala, 40 miles farther south, and a Sunderland of No. 205 Squadron, captained by F/C. D. A. Austin, set out to look for the missing boat and crew. After a search lasting nearly an hour, the fishermen were found eight miles from shore, sitting on the bottom of their capsized boat. The Sunderland dropped a rubber dinghy, in which the fishermen were able to sail back to the village, while the aircraft returned to base, having previously radioed to the police at Kalutara news of the successful conclusion of their mission.



SCALDED CAT : A Catalina of the R.A.A.F. makes the first rocket-assisted rough-water take-off in a series of tests conducted to ascertain the advantages of R.A.T.O.G. for air-sea work (see paragraph on this page).

Scottish Fighter Control Units

THE Royal Auxiliary Air Force needs more than 4,000 volunteers for its five Scottish fighter control units. Two of the units—No. 3602 (Glasgow) and No. 3603 (Edinburgh)—are already in training, and recruiting will soon begin for No. 3612 (Aberdeen), 3510 (Inverness), and 3511 (Perth). The Edinburgh unit has only about 75 airmen and W.A.A.F. in its ranks so far—about one-tenth of its requirements, while the Glasgow F.C.U., which has the largest establishment in Scotland, has a strength of only 50.

More than 20,000 volunteers—men and women—are required for fighter control units throughout the United Kingdom. The Secretary of State for Air said recently in Parliament that although recruiting results were so far encouraging, there was a long way to go before the target is reached. The work of fighter control units, in conjunction with the Royal Observer Corps, consists of radar detection and plotting of enemy aircraft, and direction of fighter defences to intercept them.

Concession to Reservists

MEN and women who volunteer for ground duties in the R.A.F. and W.A.A.F. Volunteer Reserves may now be accepted for annual training only, irrespective of their branch or trade, when they live too far from reserve centres to attend regular evening or week-end training. This concession, which is at the discretion of officers commanding reserve centres, was previously only made in the case of a limited number of ground duty branches or trades.

Canadian Jet Squadrons

THE Canadian Defence Minister, Mr. Claxton, recently announced that the first of two Vampire squadrons is now being organized at the R.C.A.F.'s new operational training establishment at St. Hubert.

Western Union Lectures

SOME 150 R.A.F. officers, selected from all home commands, and B.A.F.O. Germany, recently attended a three-day series of lectures on "Western Union and the Brussels Pact" at Chatham House, St. James's Square, W.1. This short instructional course was one of a number arranged by the Royal Institute of International Affairs at the request of the Service Departments, in which eminent speakers deal with various aspects of each subject in a series of seven lectures, with a discussion after each.

R.A.A.F. Rocket Research

THE Royal Australian Air Force's Research and Development Unit at Laverton has been testing rocket units fitted to Catalinas for assisted take-off. Rough water conditions were selected for the test, which proved to be highly successful. Four units, two on each side of the hull, were fired electrically from the cabin, the first pair when full manifold pressure was reached, and the second when indicated by the navigator. The aircraft took off in 900ft, compared with the usual distance of 3,500ft, and the use of the rockets is reported to have had no adverse effect on handling during take-off, control being, if anything, improved.

Auxiliary Appointment

IT is announced by the Air Ministry that S/L. P. C. Webb, D.F.C., is to command R.A.F. Station Dyce, and pending the appointment of an auxiliary officer, he will also assume command of No. 612 (County of Aberdeen) Squadron, R.Aux.A.F.

R.N.V.R. Technical Training

EX-SERVICEMEN with experience of aircraft maintenance in airframe or engine trades are now being recruited by the R.N.V.R. Instruction will take the form of mid-week lectures and demonstrations aboard H.M.S. *Presi-*

The newly awarded badge of the Central Photographic Establishment, Benson, bears the motto "Ex Coelis Scientia" (From the Skies comes Knowledge). Air Marshal J. W. Baker, A.O.C. Coastal Command, recently presented the badge to G/C. R. Cleland, acting C.O. of the C.P.E., at the Benson ceremony shown on the left.

B43

Service Aviation . . . . .

dent, the R.N.V.R. H.Q. ship lying off the Victoria Embankment, and week-end training at Culham, the headquarters of the London R.N.V.R. squadron—No. 1832, for which payment will be made and fares are recoverable. Volunteers wishing to take part in the course, which will comprise 20 hours of mid-week attendance and eight week-end periods annually, should apply to the London Division, R.N.V.R., H.M.S. *President*, Blackfriars, E.C.4.

R.A.F. Winter Sports

A SCHEME arranged by the R.A.F. Winter Sports Association enables members of the Service—women as well as men—to spend a fortnight's holiday at St. Moritz, Switzerland, as part of their ordinary leave. Air Marshal Sir Cyril Cooke, A.O.C.-in-C. R.A.F. Maintenance Command, will join the party leaving in the middle of February. The association has arranged these holidays in five fortnightly periods, at an inclusive cost of £39 per head, which covers fares, hotel accommodation, meals, instruction in all winter sports, and the hire of sports equipment. The first party, numbering about 60, and including G/C. R. W. P. Collings, Chairman of the Association, will arrive at St. Moritz on December 21st.

Fast Work at Celle

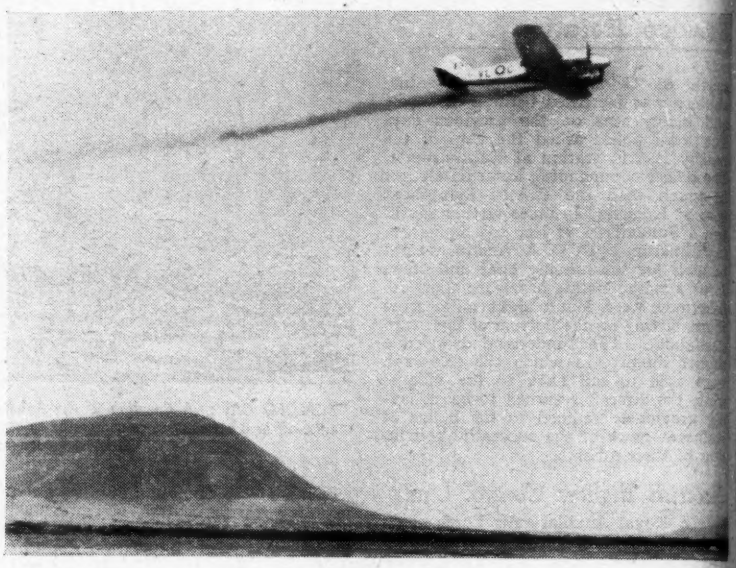
SKYMASTERS of the U.S.A.F. will use the new air-lift base at Celle, near Hanover, in the British zone, which is due to open on December 15th.

Celle, a wartime Luftwaffe transport aerodrome, formerly had temporary runways unsuitable for heavy aircraft. On October 1st orders were given to rebuild it to the standards required by the heaviest aircraft on the air-lift, and the work was entrusted to No. 5357 Airfield Construction Wing of the R.A.F. A small detachment of 14 experts, commanded by S/L. W. M. Cookson, of Bacup, Lancs, was formed to supervise the work of 1,400 locally recruited German workmen.

The new 2,000-yard runway, taxi-tracks and hard standings will cover a total area of some 314,000 square yards of newly laid tarmacadam—equal to a road 25 miles long. Twenty-five steam rollers, ten bulldozers and 150 vehicles are in use on the site. The total quantity of stone required for foundations and tarmac manufacture is approximately 100,000 tons. Some 12 miles of electric cable are being laid, and generating plant totalling 1,000 horse-power will be available for the 350 floodlights which are being installed.

R.A.F. Benevolent Fund—Scottish Branch

AT the first annual general meeting of the R.A.F. Benevolent Fund (Scottish Branch), which took place in Edinburgh on November 9th, G/C. the Earl of Selkirk, O.B.E., A.F.C., the chairman, stated that the Branch had, during its first year, dealt with 1,948 cases, and disbursed £33,767 in relief or assistance. A.V.-M. Sir John Cordingley, K.C.B., C.B.E., Controller of the Fund, mentioned that during the first nine months of this year, in comparison with the corresponding period of 1947, assistance under all headings has increased by 27 per cent, whereas income had fallen by 22 per cent.



LOCUST-KILLER: An Anson of the South African Air Force spraying locust-threatened areas in the South African Karoo with benzine hexachloride—a new bait less dangerous to crops and cattle than the arsenic formerly used.

R.A.F. Trades Reopen

SIX R.A.F. trades have recently been reopened for regular recruiting—motor cyclist, M.T. mechanic, aerial erector, barber, packer, and shoe repairer. The Air Ministry explain that the duties of aerial erectors are constructing and maintaining wood and steel towers. For the last four of the trades named only men who are already trained will be accepted.

R.A.F. Permanent Commissions

GENERAL DUTIES BRANCH.

Squadron Leaders: J. R. Bloxam, O.B.E., D.F.C., W. G. Brinn, D.F.C., D.F.M., P. G. Brodie, E. W. Deacon, D.S.O., D.F.C., T. R. Lamb, C. T. Kimber, D.F.C., E. Moody, E. Q. Moody, D. C. Sandeman, D.F.C., R. A. Watts, C. Wright, A.F.C.

Flight Lieutenants: P. Ainley, D.F.C., W. Allsopp, P. J. Anson, D.F.C., W. N. H. Brown, D.F.C., N. C. P. Buddin, J. Care, D.F.C., P. J. Clifton, J. C. H. Cole, J. D. Conry, N. L. R. Cowan, D.F.C., J. H. Davies, P. Dawes, R. V. Ecclestone, D.F.C., D. G. Evans, W. E. Evans, D.F.C., A. H. Fernand, D.F.C., B. R. W. Forster, D.F.C., H. V. Gwyther, D. A. Helsby, R. M. Horsley, D.F.C., J. R. Hemsworth, D. R. Howard, D.F.C., D. R. Locke, I. C. Macrae, R. W. Mason, J. H. J. Merriman, D. O. Miller, A. D. Munday, P. Needham, A. J. Owen, D.F.C., D.F.M., L. J. Palmer, K. V. Panter, D.S.O., V. A. Pengilley, P. D. Petrie, D.F.C., J. E. Petty, A. G. Reid, D. S. M. Scott, A.F.C., J. E. Staples, D.F.M., A. H. Stott, G. R. Turner, E. L. Wallane, R. S. Whittington, H. P. Williams, D.F.C., J. G. Wilson, E. T. Wood, E. R. J. Wythe.

Flying Officers: A. E. F. Buick, J. Ellerington, G. E. G. Galletly, D. J. Leith, B. Lewis, A. R. Lightfoot, F. A. B. Newton, K. N. J. Parsons, D. J. B. Whitehead.

TECHNICAL BRANCH.

Squadron Leaders: A. H. Draper, D.F.C., M. L. Formby, W. J. Read, J. A. R. M. Reid, W. J. Renwick, R. G. Simmons, G. G. S. Tayler.

Flight Lieutenants: R. Agnew, C. C. Berry, D.F.C., G. G. Bevan, A. Bond, C. E. Cockle, H. H. Dent, R. Dimberline, R. M. Guthrie, L. G. Hopkinson, E. A. T. Mack, J. G. Redman, R. A. A. Simpson, J. W. C. Smith, J. G. Tolley, C. F. Whitehouse, P. R. Wilkinson.

Flying Officers: K. W. Goodman, J. W. Pettigrew.

EQUIPMENT BRANCH.

Squadron Leaders: J. R. Fisher, W. G. Maxwell.

Flight Lieutenants: B. Chapman, T. Crow, V. E. Darley, A. Lawrence, J. T. Leslie, J. Ross, G. T. M. Webb.

Flying Officers: H. G. Birtchnell, J. H. Cooke, R. O. Healey, B. Millman, K. Noppard, W. F. Nurse, D. P. McL. Tooke, C. W. Underwood, R. P. Wilson, F. E. Wooley.

Pilot Officers: F. R. Joynson, P. C. B. Ratcliffe, R. H. Ross, K. R. Willy.

SECRETARIAL BRANCH.

Squadron Leaders: H. E. Angell, D.F.C., A. J. Bartram, F. T. Collins, D.S.O., W. H. J. Daw, A. C. Dunn, M.B.E., D.F.C., L. R. C. Gilbert, D.F.M., A. Haywood, D. H. Keary, D.F.C., G. E. Pinney, C. N. Pollock, A. H. C. Roberts, D.S.O., D.F.C., G. H. Saunders, E. H. G. Stringer, D.F.C., H. E. Trett, V. C. Woodward, D.F.C.

Flight Lieutenants: E. Anslow, D.F.C., J. Brodie, J. E. Brough, S. M. W. Cadwallader, J. W. A. Daley, R. F. T. Doe, D.S.O., D.F.C., D. A. Drewitt, D.F.M., H. Edwards, D.F.C., J. A. Ellice, S. H. K. Eyre, D.F.C., G. A. Harrison, L. Jones, D.F.C., S. Kirtley, R. H. Knight, D.F.C., S. E. Knight, G. E. Lewis, W. L. Martin, A. F. Merritt, J. D. Oldham, R. C. Parks, H. F. Pullen, D.F.C., A. A. Purdom, E. A. Ray, J. Robinson, D. A. Shaw, D.F.C., A.F.C., W. J. Warn, D.F.C., F. S. Waldren, D.F.C., C. T. Williams, A.F.C.

Flying Officers: A Clare, J. R. Evans, K. Holden, T. J. Page, D.F.M., D. W. Reid, R. J. Salisbury, F. T. Trahair.

AIRCRAFT CONTROL BRANCH

Squadron Leaders: L. S. M. Bailey, J. M. Evans, A. R. Pruddah.

Flight Lieutenants: H. R. Barrand, L. Y. J. Friend, D.F.C., S. V. Holloway, E. Knowles, D.F.M.

Flying Officers: J. F. Crowley, D. F. J. Smith, D.F.C.

PROVOST BRANCH.

Squadron Leader: L. Wilson.

Flight Lieutenants: C. W. Hogben, J. L. Schooling.

Flying Officers: E. W. Bird, N. Burton, F. J. Cuttill, C. B. Flockhard, D.C.M., D. S. Hodge, E. T. Inions.

R.A.F. REGIMENT.

Flight Lieutenants: D. J. George, H. W. Kelly, B. M. Taylor.

Flying Officers: S. G. Bayley, M. O. Bell, J. D. Belshaw, W. J. Knapp.

Pilot Officer: V. J. Fallon.